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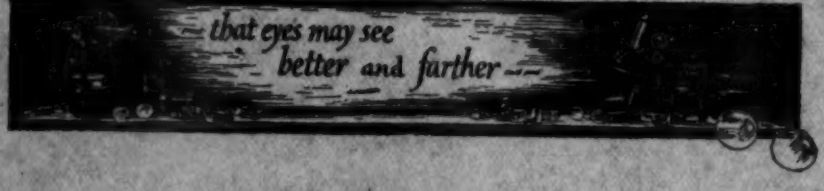

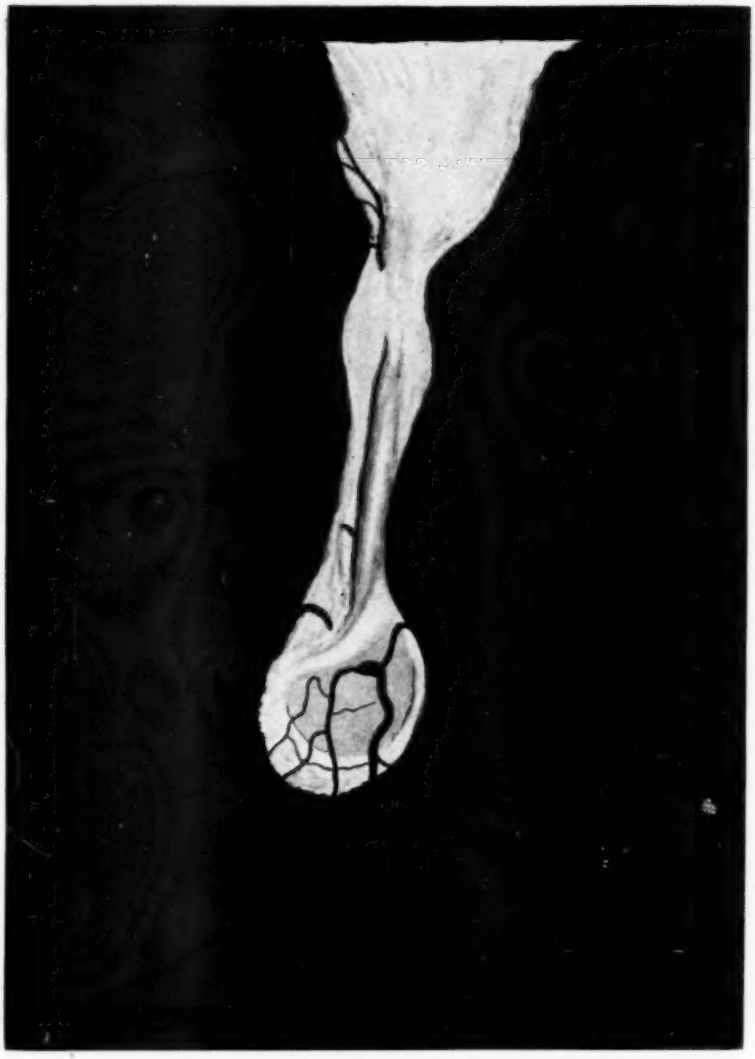

FIG. 1. ANOMALY OF FUNDUS (FINNOFF)

FIG. 2. TUBERCULOSIS OF CONJUNCTIVA (COOVER)

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ANOMALOUS CONDITION OF OCULAR FUNDUS.

WILLIAM C. FINNOFF, M.D., OPH.D.

DENVER, COLORADO.

This case of probably congenital anomaly of the eye was presented at the Colorado Congress on Ophthalmology and Oto-Laryngology, August 4, 1919. It is of interest in connection with a paper of Dr. Gifford on Atypical Coloboma, see page 97.

As unusual fundus pictures are always of interest to the ophthalmologist, I take the liberty of presenting this case.

B. P. K., age 20, a mechanic by occupation.

The patient has always enjoyed good health and believed his eyes to be normal, except for a slight divergent squint, until six years ago when he had tonsillitis. While he was under a general anesthetic for the removal of tonsils, some ether was accidentally dropped into the right eye which produced some irritation and called his attention to this eye. At this time he discovered that he could see very little with it, and believed that the loss of vision was due to the ether.

The patient consulted me May 24, 1919, to learn the cause of his unilateral blindness, and to see if his divergent squint could be corrected. His vision with the right eye was 0.03, left 1.4. With the ophthalmoscope the media were found to be clear. Only the lower 2/3 of the disc could be made out, and to the temporal and lower side of it a white scleral crescent 1/3 disc diameter could be seen. The crescent is bordered with a band of pigment which is thinnest on the nasal side, and thickens out to 1/3 disc diameter on the temporal side. A veil-like membrane is noted beginning on the disc and covering the upper 1/3 of it. This structure runs upward and slightly to the nasal side, is funnel shaped, and the front part rapidly comes forward into the vitreous until it is best seen with a +8. D. lens. The base of the funnel flattens, is quite far in front of the equator, and is bordered by a thin band of pigment. On the surface of the funnel, beginning at the disc, a greenish glistening fold can be seen farther forward in the vitreous, which later blends with the main mass as it comes forward at the junction of the middle with its upper third. To the temporal side and at the base of this fold a portion of the upper temporal vein can be seen. (See color plate III, Fig. 1.)

The distribution of the retinal vessels is anomalous also. The retinal artery makes its appearance to the nasal side of the disc opposite the beginning of the membranous fold and divides into three branches. One branch runs upward along the edge of the fold for a short distance and disappears under it. Another branch courses downward and to the nasal side and constitutes the lower nasal artery. The third branch takes a tortuous course across the upper portion of the disc for about two-thirds of its diameter, then bends acutely and runs downward, giving off small branches in its course along the disc. This branch corresponds to the lower temporal artery. Another artery, which supplies the upper temporal region of the fundus, is first seen emerging from the membrane which covers the disc. It passes over the temporal half of the membrane and dips down over its edge in reaching the retina, after which it passes normally to the upper temporal portion of the fundus.

One large vein is seen entering the disc. It is made up of three branches, two from the lower nasal quadrant, and one from the lower temporal. It passes over the disc and just before disappearing into the nerve head hooks over the artery. A second vein passes thru the veil-like membrane and receives branches from the upper temporal quadrant.

Because of the peculiar disc and the unusual arrangement of the retinal vessels, I believe this to be a congenital condition. A retinitis proliferans in this region would not be accompanied with an absence of retinal vessels in the upper nasal quadrant of the fundus. The anomalous position of the vessels also is very suggestive of a developmental defect.

ALTERATIONS IN TWILIGHT VISION IN OCCUPATIONAL NYSTAGMUS.

Dr. L. Weekers,

LIEGE, BELGIUM.

Observations on the hemeralopia of soldiers seem to throw light on the pathology of miners' nystagmus, indicating that both these and similar conditions arise largely from over-fatigue.

In an article published in 1910 (1) I emphasized the importance of hemeralopic affections in relation to the nystagmus of coal miners. From measurements made with Nagel's adaptometer it was possible to study graphically anomalies of retinal adaptation causing these affections. But the pathogenesis of the changes was left undetermined.

Observations which I was able to make during the war on cases of hemeralopia occurring in soldiers have thrown light on this subject; and at the same time they help to make clear another question, the pathogenesis of professional (workers') nystagmus.

During the war the problem which presented itself was: Men who before the war or even during the early months of the war had good nocturnal vision, complained suddenly of poor vision at night; tho their vision remained good during the day; and no lesion, either of the visual tracts or of the fundus could be observed, which might explain the defect in retinal adaptation.

It is important to establish these facts because several observers have emphasized certain forms of hemeralopia, known before the war and observed also in combatants, notably hemeralopia associated with anomalies of the pigment of the fundus, associated with lesions of the choroid or retina, with opacities of the cornea, and so forth.

The frequency of the cases of hemeralopia without objective lesions, varies with the reporter, but from none do they receive recognition as such. Personally at the Belgian front, I have observed this condition in nine per cent of all those coming to consult an oculist.

The particular symptoms of insufficiency of retinal adaptation are well known; and I shall not dwell here upon the clinical aspect of these affections. They have been described often during the war. I wish simply to show how I have been led to attribute hemeralopia among combatants to overfatigue (2).

To sum up the causes, which from the clinical point of view underly change in twilight or night vision, I have arranged the following table.

I. HEMERALOPIA FROM A LOCAL CAUSE.

A. Hemeralopia from an external cause, as from dazzling.

B. Hemeralopia from a dioptric cause: Opacities of the cornea or of the lens; changes in the pupil; ametropia.

C. Hemeralopia from a local cause due to change in the retina.

1. Acquired hemeralopia: siderosis, neuro-retinal atrophy (as in glaucoma), chorio-retinitis, myopia, etc.
2. Congenital hemeralopia—Hereditary hemeralopia.

II. HEMERALOPIA FROM A GENERAL CAUSE.

A. Hemeralopia from malnutrition, as observed in orphanages, penitentiaries, among sailors, etc.

B. Hemeralopia from over-fatigue: as among combatants, workers, miners.

C. Hemeralopia in infectious diseases; malaria, syphilis, etc.

D. Toxic hemeralopia; from santonin, quinin, alcohol, etc.

E. Autotoxic hemeralopia; from disease of the liver, nephritis, etc.

F. Diseases little understood; retinitis pigmentosa, certain forms of hereditary hemeralopia.

By the exclusion of other causes of hemeralopia, and by the clinical study of this particular form, I have come to the conclusion that the principal cause of the hemeralopia of war should be sought in fatigue, in exhaustion (3).

It is not unusual to observe in combatants with acquired hemeralopia marked signs of depression, notably cephalalgia, vertigo, insomnia, tachycardia and arterial hypotension. Likewise the anomalies of peripheral vision, especially contraction of the fields for color, described by some authors (Knies, Jess, etc.) are to be observed in the over-fatigued or exhausted.

Nervous depression among combatants is only too easily explained by the fatigue and danger to which they are exposed, by the monotony and unhygienic character of trench warfare, by the lack of regular sleep and by the shocks to which the nervous system is subjected.

The presence of symptoms of depression in hemeralopic soldiers has been confirmed by several observers; Landolt (4) Teulieres (5), and Caillaud (6) in the French army, Danis (7) in the Belgian army, Paul (8) and others, of the enemy.

It is to be attributed to the influence of fatigue that the hemeralopia of war is found, if not exclusively, at least to a large extent in the infantry. Because of the continual change of place, the long marches, and the considerable weight of equipment (more than 30 kg.), the foot soldier is far more liable to exhaustion than those in other branches of military service.

Another reason for attributing war hemeralopia to over-fatigue is the fact that the proportion of cases in the Belgian army decreased according as the conditions of that army improved. My first observations were made in the latter part of 1914 and in 1915, following the battle of the Yser, at a time when the Belgian army had after successive retreats offered a desperate resistance under the most unfavorable conditions. To show the state of destitution of our army at that time, I shall offer but one example. Many of our men, having worn out their leather shoes, were obliged to make long marches to the trenches in wooden shoes, or even bare-footed. My statistics belong to this period. Nine per cent of those who came for ophthalmic consultation were hemeralopes.

This critical period for the Belgian army was followed by a veritable renaissance. A new army was somehow born of the old one, and simultaneously the proportion of cases of hemeralopia decreased. For 1916 and 1917 my statistics show only 3 per cent.

The same conditions existed in the Serbian army. After a perilous retreat across Albania numerous cases of hemeralopia appeared. (Nechitch.) (9).

There exists clinically an insufficency of retinal adaptation, due preeminently to exhaustion, thru muscular and nervous fatigue, which one may designate hemeralopia of over-fatigue.

This form should be distinguished from hemeralopia due to malnutrition, for it can arise, as I have shown, aside from any alimentary defect, in subjects who in that respect are in very satisfactory condition.

It would be interesting to make tests with the adaptometer, to see whether insufficiency of retinal adaptation is not also present in other clinical forms of over-fatigue, or of asthenia; where it might easily pass unobserved be-

cause of the absence of the special conditions, chiefly nocturnal, under which combatants work.

How can an excess of muscular and nervous fatigue cause a change in retinal adaptation which manifests itself as hemeralopia? As the physiology of normal retinal adaptation is as yet poorly understood, one must review the facts of this special condition with great care. Fatigue, exhaustion, and emotion produce profound changes in the human organism. Interesting observations along this line were made among the soldiers. Vincent (10) especially has shown that over-fatigue lowers the alexic power of the blood serum. Hurst (11) insists that the emotions of combatants are followed by hyperadrenalism and hyperthyroidism and their consequences. One may therefore ask if the function of adaptation is not directly or indirectly affected by the same pathogenic factors.

In the studies which I have made of the question (12), I have shown that over-fatigue changes the functioning of the endocrin glands, or at least of some of them. I have next enumerated the things which tend to the impairment of retinal adaptation, also resulting in disturbance of the internal secretions.

The facts which I have just mentioned, explain also the hemeralopia so pronounced in the nystagmus of miners, the pathogenesis of which was unknown before the war. Like the soldier, the coal miner leads a dangerous and fatiguing life; the unfavorable conditions of which are well-known. It is not unusual to see, in coal miners afflicted wtih nystagmus, symptoms of nervous depression similar to those I observed in hemeralopic soldiers, especially cephalalgia, insomnia, hypochondria, arterial hypotension, etc.

Among coal miners with nystagmus I observed before the war in extreme cases a veritable neuro-ophthalmic condition, altho I do not claim that all coal miners afflicted with nystagmus are neurotic. Nystagmus aggravated by neuropathic symptoms is unusual.

However, these extreme cases direct our attention to the pathogenic importance of over-fatigue, and of the nervous disorder which follows it.

Visual fatigue, manifested as nystagmus, results from the effort to see under poor conditions, as in the coal mines. This local sensorial fatigue added to general over-fatigue is of more marked importance in coal miners than in combatants in the production of hemeralopia. A whole series of well established facts confirms the poor conditions of work at the bottom of a mine from the point of view of vision.

Professor Nuel (13) insisted upon the importance of two factors which destroy the muscular equilibrium usually controlling vision; the failure to function on the part of the fovea, and the upsetting of binocular vision.

We must recall that it is above all the fovea which controls ocular movements. In a poor light, one sees not with the cones of the retina, but with the rods. The fovea has no rods and the macula has only a few. The better vision in a poor light is obtained by the extra-foveal portions of the retina, from 15° to 20° away from the fovea, and extending in a circle around it.

In the coal miner who does all his work in a poor light, the foveal vision, which would under normal conditions regulate the movements of the eyes, is lacking. Hence there results a sort of visual groping, from the incoördination of the movements and also from the visual fatigue.

On the other hand, binocular vision also must be maintained under abnormal conditions. The broken coal has an angular and crystalline surface. The lamp, lighting some of the facets, is reflected. Each eye sees different facets destroying binocular vision, and fatiguing the eyes.

There are other factors resulting from the conditions at the bottom of the mine, which contribute to visual exhaustion. It is scarcely necessary to mention among these the insufficient light which has latterly been considered the predominant influence in the pathogenesis of nystagmus. It has been shown that the number of cases

of nystagmus has increased with the introduction of safety lamps, which give but a poor light. In mines without fire-damp, lighted by acetylene or electricity, nystagmus is rare.

The necessity for looking upward when working at the bottom of a mine is also a cause of visual fatigue. Dransart (14) emphasized the importance of this factor as a cause of the oscillations of nystagmus. To these various causes of visual fatigue in coal miners, one may add the sudden and frequent passing from light to darkness in going down into and coming up from the mine.

It is to be remarked that hemeralopic affections identical with those observed to accompany the nystagmus of miners have been found in those doing work resembling coal-mining in its unfavorable conditions. For example in the building of the St. Gothard tunnel numerous cases of hemeralopia appeared among the workers.

I intend to make observations with the adaptometer to see whether this insufficiency of retinal adaptation does not appear in other clinical forms of over-fatigue; where the patient does not become aware of the defect, even tho it be marked, because he does not, like the soldier and miner, work under nocturnal conditions. This we know is the case with patients suffering from ocular disease like retinitis pigmentosa.

The influence of visual over-fatigue in producing hemeralopia is demonstrated by an observation of Percival (15), relating to a railway employee who passed the entire day in adding long columns of numbers. At length hemeralopia appeared and simultaneously nystagmic movements.

The nature of this twilight blindness in the nystagmus of miners, its analogy to hemeralopia in soldiers, the relation to fatigue and exhaustion, more particularly the latter, throws light on the pathogenesis of nystagmus. There is great uncertainty concerning the etiology of occupational nystagmus, Ohm attributes it to alcoholism, insufficiency of convergence, disturbances of the labyrinth and, finally, to poor illumination. It appears to me, however, that it is not impossible to clear up this problem when we hold to the solid ground of well-known clinical facts.

Nystagmus of miners does not consist wholly in the ocular displacements, but includes insufficiency of retinal adaptation; and equally general symptoms, which may be attributed to fatigue, exhaustion, symptoms usually slight but which can develop marked neuropathic manifestations. The different symptoms that characterize miner's nystagmus, to my mind show incoördination of the nervous system due to bodily and visual exhaustion, the depressed condition, arises not from a single factor, but in a concurrence of many general and local causes of varying importance.

The reader of works concerning the pathogenesis of nystagmus gets the impression that each author, thru his "amour propre"—quite human on the whole—obstinately defends the importance of his own suggestions. This is proper, but necessarily the relative value of the facts is obscured. In reality the principal factors which have been incriminated in the causes of nystagmus all have some importance, and help to create the fatigue and exhaustion which occasion the disturbance of the nervous system, particularly the visual centers, of which the ocular movements are the most evident symptom. I make the additional suggestion that dark adaptation is a function not only of the retina, but also of the cerebral centers, and as such may be especially affected by over-fatigue.

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IMPROVED METHOD FOR TOTAL ENUCLEATION OF EYEBALL.

FREDERICK KRAUSS, M.D.,

PHILADELPHIA.

The operation here described aims at preserving the relations of the recti tendon with Tenon's capsule.

The operation of simple enucleation of the eyeball has been always considered an easy one, and frequently assigned to the resident. The general surgeon has felt that it was within his field of action. The result is usually a permanent deformity to the individual thus operated. To overcome this deformity, the operation has been modified by implantations of foreign bodies in Tenon's capsule or sclera, in various ways. A very ingenious method is that recently suggested by Dimitry. (A.J.O. v. 2, p. 653.)

The modifications that I now present were suggested by the fact that in ordinary tenotomy, we will say, of the internal rectus, if a free incision is made in Tenon's capsule after the separation of the internal rectus from the sclera, the result will be almost complete abolition of the movement inward of that eye.

The same thing is done to all the eye muscles and Tenon's capsule in the ordinary method of enucleation. This can be overcome by using catgut sutures thru the lateral muscles, attaching it to the Tenon's capsule of the opposite side, thus completely closing the space formerly occupied by the eyeball. Secondly: Tenon's capsule can be carefully separated so that practically none of Tenon's capsule is sacrificed, and consequently there is no tension, but quick healing. To do this it is necessary that the conjunctiva be primarily dissected loose from Tenon's capsule into the fornix. After the wound in Tenon's capsule is closed, the conjunctival wound is closed with catgut sutures at right angles to the opening in Tenon's capsule.

This allows the conjunctiva to seek its correct adhesion on the mobile Tenon's capsule, which latter is filled with a blood clot which probably organizes, and forms at least a temporary filling of Tenon's space, replacing the fat, tendon, glass or gold ball of implantation operations.

The advantages are:

1st. The full vitality and strength of the muscles of the eyeball are retained, giving movable socket with a minimum of retraction, or falling of the upper lid.

2nd. In addition to the excellent stump obtained, there is no violent reaction following this operation, as there often is in the gold ball implantation in the sclera.

3rd. There is no danger of extrusion or sympathetic ophthalmia, as there is at times in the implantation of a foreign body in Tenon's capsule.

4th. There is no after bleeding or secretion, and a welcome absence of the catarrh that so frequently follows an enucleation.

The improvements that I suggest are in the method of application of the catgut sutures to the recti and Tenon's capsule,—in the care to preserve entirely Tenon's capsule by separate dissection,—finally covering the same

with a separately detached conjunctiva.

I realize that it is difficult to suggest anything absolutely new in ophthalmic surgery, and others may have used this method of operating. The result is such a remarkable improvement that I beg to have you try it.

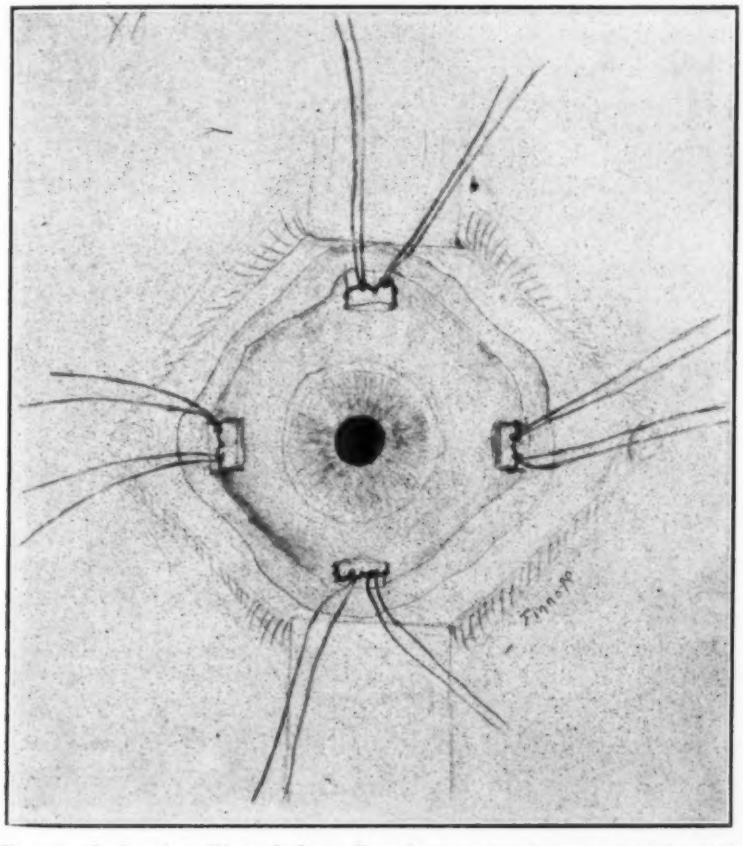

Fig. 1. Conjunctiva dissected from Tenon's capsule. Sutures placed in recti tendons and tendons divided.

OPERATION.

The patient is prepared in the routine way for ether operation. The local field is prepared to produce aseptic results according to custom.

After introduction of the eye speculum, the conjunctiva is carefully dissected from close to the cornea back into the fornix until it is entirely free from Tenon's capsule.

The internal rectus is caught upon a hook, Tenon's capsule slit parallel to the tendon close to its insertion, so that the hook is perfectly free in that position.

A catgut thread 0 size (not chromicized), is threaded with three needles. The first needle is passed under the muscle to the opposite side, the second needle is passed thru the center of the muscle. The loop thus formed is cut close to this second needle. The ends are then tied over the upper and lower half of the muscle respectively, the end of the catgut being retained.

This preparation is similar to that usually taken in advancement operations of the muscles of the eye. The tendon is then cut close to the eyeball and the ends of the catgut caught by a hemostat, and placed out of the way. The recti muscles are all treated in the

same way, giving the result shown in Fig. 1.

The capsule of Tenon is still intact if care has been taken to dissect only the conjunctiva as advised. The capsule is then carefully separated from the eyeball by introduction of a curved

site side and tied, thus closing in the central part of Tenon's space containing the blood clot. The somewhat triangular spaces above and below these sutures are closed by the superior and inferior recti sutures, in the following manner:—The one catgut holding the

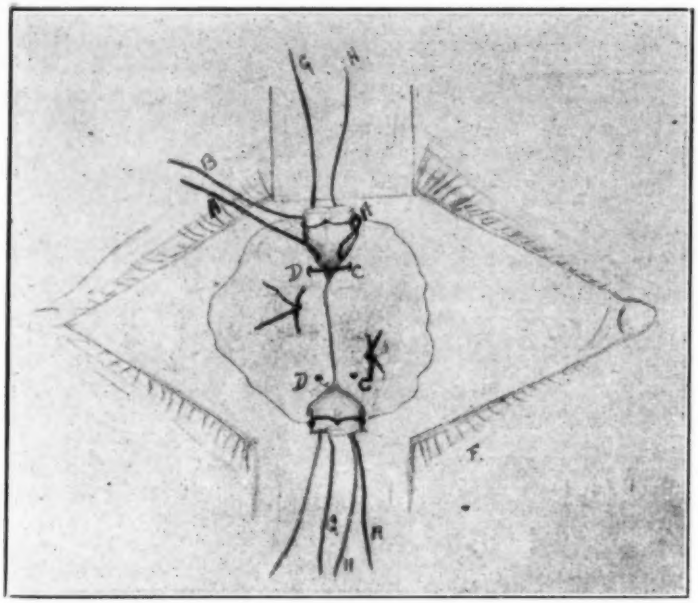

Fig. 2. After enucleation sutures from internus pass thru Tenon's capsule to temporal side and tied; sutures of externus pass thru Tenon's capsule to nasal side and tied. One thread from superior rectus starting at A is carried thru capsule from within outward at C, then, from without inward at D, and finally tied to B, after G and H are cut short, burying the end of this tendon. The inferior rectus tendon is to be treated the same way, the suture A to be carried beneath the capsule brought out at C, introduced again at D and brought from beneath the capsule to be tied to B.

pair of scissors, beginning at the insertion of the internal rectus, hugging the eyeball. After complete separation, the eyeball can be enucleated in the usual manner by cutting of the optic nerve.

After primary bleeding has ceased, under pressure, the Tenon's capsule is filled with a blood clot, and is readily outlined by tension on the sutures introduced thru the muscles. The wound is then sutured as follows: The catgut sutures of the internal rectus are passed thru the Tenon's capsule of the opposite side directly below the insertion of the externus and tied. The sutures of the externus are then passed thru the Tenon's capsule of the opposite rectus tendon is passed thru the neighboring capsule from within, out—then thru the capsule on the opposite side of this triangular space, and tied to another thread still attached to the superior rectus.

This forms a sort of purse string suture, completely closing the upper opening in Tenon's capsule. The same thing is done to close the lower opening. We then have a closed Tenon's capsule with the muscles in as nearly normal position as possible. The internus is given the preference in the attachment to Tenon's capsule as it is the strongest and has the most motion.

Finally the conjunctival wound is

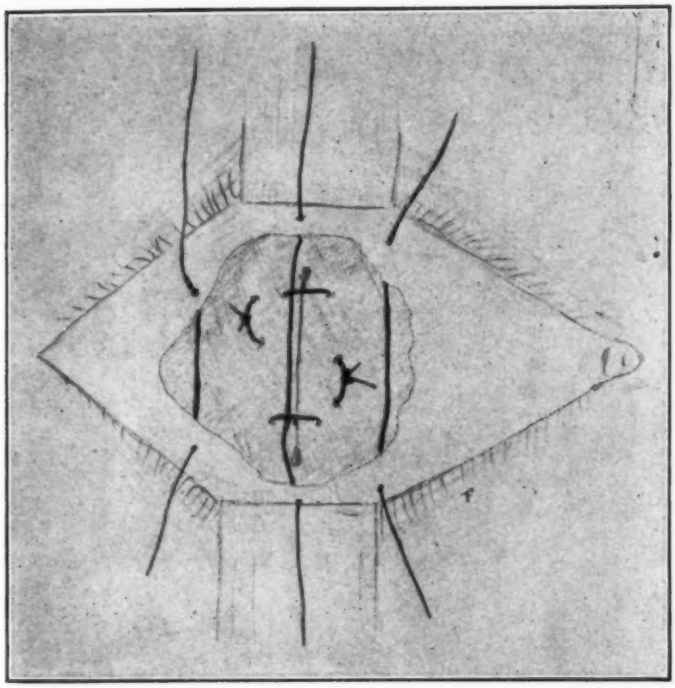

Fig. 3. Shows sutures tied, closing the capsule, and others placed for closing the conjunctiva.

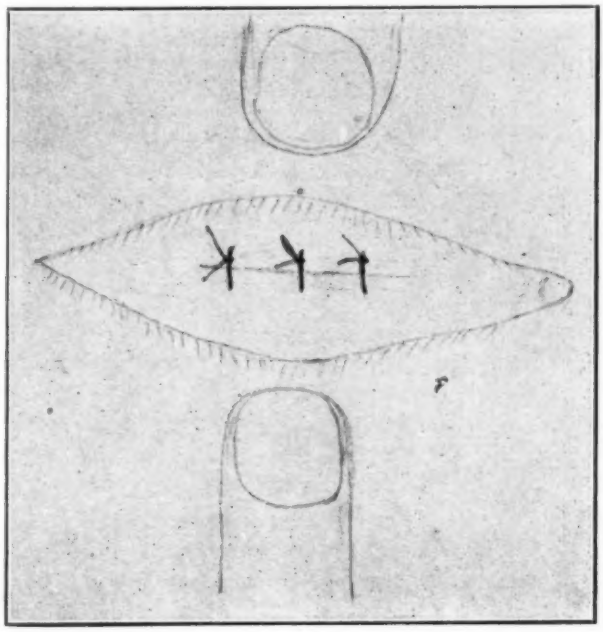

Fig. 4. The conjunctival sutures tied, completing the operation.

closed horizontally, burying Tenon's capsule. Both eyes are kept bandaged for forty-eight hours, as a precautionary measure.

The appearance of the socket after this operation presents a clean surface with no granulating areas and no bleeding. Healing is by first intention with perfect motility, due to the normal attachments of the muscles.

EFFECT OF NOSE AND THROAT INFECTIONS UPON OCULAR FUNCTIONS OF AVIATORS.

MAJOR CONRAD BERENS, M.C., AND CAPT. CLAUDE T. UREN, M.C.

NEW YORK CITY. OMAHA, NEBRASKA.

This report from the Medical Research Laboratory of the Third Aviation Instruction Center, A. E. F., deals with cases under the care of both the otological and the ophthalmological departments, showing the conditions encountered and the details of individual cases. Authority to publish granted by the office of the Surgeon-General.

In studying the results of operative interference in nose and throat infections, of thirty-eight (38) pilots at the 3rd Aviation Instruction Centre, A. E. F., it was found that many of the men who required operation by the Otological Department were diagnosed temporarily unfit to fly by the Ophthalmological Department. Therefore the eye records were examined to see if it were possible to answer the following questions:

1. How many pilots requiring operation by the Otological Department were under observation in the Ophthalmological Department? And what were the diagnoses in that department?

2. What relation existed between the nose and throat infections and the blind spots? If any change in blind spots was noted, what were the results of treatment?

3. Was vision affected and if so how was it influenced by treatment?

4. What was the effect of these infections upon the extra, and intraocular muscles? What results were obtained by treatment?

5. What did the history and physical examination of these pilots reveal?

Situated as we are, it has been impossible to refer to the literature, with the exception of part of the literature of aviation medicine; which, to our knowledge, does not deal with this subject.

The number of cases presented is small and the time of observation of necessity was short, but the apparent lack of literature on this subject in aviation medicine made us feel that a statement of our findings was justified.

1. In answer to the first question the following data were found:

Records of thirty-eight pilots treated by the Otological Department were found in the Ophthalmological Department. Nineteen or 50 per cent showed some ocular trouble, which possibly had infection of the nose and throat as the underlying cause. Search was made, by means of X-ray and laboratory examination in addition to physical examination, for other foci of infection. The ophthalmologic diagnoses were as follows:

Retrobulbar neuritis, six or 15.80%.
Convergence weakness, nine or 23.63%.
Divergence excess with convergence insufficiency, one or 2.63%.
Acute catarrhal conjunctivitis, one or 2.63%.
Marginal blepharitis one, or 2.63%.
Photophobia and lacrimation one, or 2.63%.
(Blind spots not examined in last case.)

2. Our second question is given the following answer:

Six, 15.80 per cent of the thirty-eight pilots showed definite enlargement of

one or both blind spots. The blind spots were examined by a rapid clinical method and compared with findings on the Bjerrum screen. The head was fixed in position by means of a tongue depressor mouth bite fixation, so that the cornea was 27 cm. from a 1 mm. black dot on a white or cream colored card, attached to the arc of a perimeter. One eye was covered, or binocular fixation was obtained, by using a metal cylinder placed on trial frame before one eye. The limits were determined by the use of a 2 mm. black test object on the end of a fine light colored steel rod, and outlined in pencil on the card. Resumé of the history of six pilots diagnosed Retrobulbar Neuritis:

1. R. C.

Referred from Nose and Throat Department Oct. 12, 1918.

Nose and Throat diagnosis—Deviated septum. Infection of sphenoidal and posterior ethmoidal sinuses (bilateral).

Eye examination: V. R. 20/15-4. V. L. 20/15-2.

Muscles: 6 meters:—Esophoria ½°. Divergence 5°. Convergence 8°. 25 centimeters:-Exophoria 11°. Divergence 21°. Convergence 15°.

Chief complaint Photophobia.

Examination including central color vision, fields and fundi, normal except that the right pupil was 1 mm. larger than the left. Physical examination was negative except for a subacute bronchitis.

Oct. 18, 1918. Submucous resection of nasal septum.

Oct. 22, 1918. Enlarged blind spots.

Eye Diagnosis—Retrobulbar Neuritis (Bilateral). Convergence weakness.

Oct. 23, 1918. Convergence weakness shown by ergograph. To have converging exercises three times a week.

Oct. 26, 1918. Blind spots normal and convergence fatigue less marked.

Nov. 4, 1919. Convergence fatigue normal.

Nov. 8, 1918. Near point of convergence 60° 6 meters, Divergence 4°, Convergence 30°.

Results: Nasal, physical and ocular conditions improved. Continued training as a pilot.

2. L. W. B. 2nd Lt. A. S. 24, Single. Oct. 8, 1918.

Chief complaints: Photophobia, dull pain back of eyes. Right eye vision blurs periodically. Smokes cigarettes. Does not drink. Denies venereal infection. Has had no trouble in flying.

Photophobia. Pain back of eyes and blurred vision for one month. Dilated right pupil noted one month ago.

Eye examination: V R. 20/40—1. L. =20/15—1. R.+0.75 cyl. ax. 90.= 20/20—4. L. +25 cyl. ax. 90° 20/15.

N. P. C. 65 mm. N. P. A. both 105 mm. 6 Meters Ortho. 25 cm. Ex. 29° R.: Globe is tender and there is tenderness upon pressure back of globe Rt. pupil 4½ mm. Left pupil 3½ mm. Rt. reacts slightly to eserin. Rt. nerve slightly congested. Central color vision normal. Rt. blind spot greatly enlarged.

L.: Blind spot slightly enlarged.

Diagnosis: Retrobulbar Neuritis. (Bilateral.)

Ear: Negative. Nose: Chronic hyperplastic rhinitis. More marked on right side. Bilateral infection of the posterior ethmoidal and sphenoidal sinuses. Deviation of nasal septum. Throat: Chronic follicular tonsillitis. Teeth: Normal. Medical: Negative. Neurological: Negative. Laboratory: Negative.

Course and treatment: On Oct. 12, 1918, submucous resection of the nasal septum, followed by local treatment.

Oct. 21, 1918. Blind spots smaller.

Nov 17, 1918. Vision with correction. L. 20/15. R. 20/20—1. Rt. pupil still dilated. Photophobia. Rt. blind spot still slightly enlarged. Nose shows a marked improvement.

Results: Ocular improvement seemed to be in conjunction with nasal improvement.

3. T. R. 1st Lt. A. S. 25 yr. Single. Oct. 25, 1918.

Chief complaint: Referred because of many bad landings.

Previous history and habits: 15 cigarettes a day. Wine, no spirituous liquors, never to excess. Denies venereal

infection. Pneumonia eight years ago, no complications. Wears reading glasses occasionally. Otherwise eyes normal. Has had many poor landings. Had one crash from altitude 1,200 meters. Slight injury to back but able to keep on flying.

Present history: Feels well at present. Is nervous about landings. Eyes tire easily and ache at times.

Physical Examintaion:

Eye V. both 20/20—1. N. P. C. 40 mm. N. P. A. both 12 mm.

Muscles 6 Meters—Ex. 1°—Divergence 5°. Convergence 8° 25 cm. Ex. 3°. Divergence 15°. Convergence 16°.

Both blind spots somewhat enlarged. Left more than right.

Ocular examination including central color vision negative.

Diagnosis — Retrobulbar Neuritis. (Bilateral). Convergence weakness.

Ear: Negative.

Nose: Negative.

Throat: Large mass of adenoids—Septic tonsils.

Dental: Negative.

Medical: Negative.

Psychologic: Negative.

Neurologic: Negative.

Treatment and course:

Nov. 9, 1918. No improvement. Refused operation.

Results: Removed from flying and given ground position.

4. J. C. K. 2nd Lt. A. S. 23. Single. October 4, 1918.

Chief complaint—Constipation, nervousness, sleeps poorly, appetite poor, feels constantly fatigued, blurred vision and photophobia.

Past history: Three cups of coffee a day. No alcohol, no tobacco, never has had trouble with eyes.

Eye examination: R. 20/15+3. L. 20/30—2. Refraction, homatropin, accepted plus .25 cyl. ax. 90° (but this did not improve vision).

Near Point Convergence 275 mm.

Near Point Accommodation R. 114 mm. L. 260 mm. 6 meters:—Divergence 4°, Convergence 6°.

Fundi normal. Central color vision normal. Fields contracted, more on the left.

Ear: Nerve deafness left ear.

Nose: Normal.

Throat: Considerable amount of pus expressed from both tonsils. Moderate mass of adenoids.

Dental: Negative.

Medical: Fatigued and nervous.

Neurologic: Negative.

Psychologic: Negative.

Laboratory: X-rays of head (two examinations) Negative.

Wassermann blood test negative. Spinal fluid negative.

Diagnosis: Retrobulbar Neuritis (Infectious).

Treatment: Adenoids and tonsils removed Oct. 10, 1918.

Complained of severe pain in eyes when tonsils were removed.

Both blind spots greatly enlarged after operation.

Septic clot in tonsillar fossa.

Converging exercises, and plind spots taken at regular intervals, showing no improvement. Blind spots greatly enlarged and out of proportion. No change in central color vision.

Dec. 31, 1918. V. R. 20/50—2. L. 20/50—2. N. P. C. 440 mm. N. P. A. R. 380 mm. L. 410 mm. 6 Meters:—Divergence 2°, Convergence 3°.

Fields contracted, left more than right. Blind spots greatly enlarged, left more than right. Retrobulbar tenderness, slight pallor of left optic disc; central color vision normal.

Ordered to the United States after this examination.

Result: Ocular condition worse. General health improved.

5. C. H. S. 2nd Lt. A. S. 24. Single. Oct. 30, 1918.

Wore glasses for a time for close work.

Smokes seven cigarettes a day.

Does not feel well. Headaches. Sleeps poorly.

Eye exam.: R. 20/10—2.

L. 20/10—1.

N. P. C. 350 mm. N. P. A. R. 100 mm. L. 105 mm.

Rt. blind spot slightly enlarged.

Diagnosis: Retrobulbar neuritis R.

Ear: Negative.

Nose: Acute empyema right antrum. (Cleared up in two days, with treatment of nose.)

Throat: Pus in both tonsils.

Dental: Negative.

Medical: Recovering from influenza.

Neurology: Negative.

Psychology: Negative.

Laboratory: X-ray shows cloudiness of right antrum.

Treatment: Tonsillectomy Nov. 5, 1918.

Nov. 15, 1918—Throat healed, feels better, headaches gone. Blind spots normal.

Results: 1. Ocular condition improved. 2. Physical condition improved.

6. R. G. W. 2nd. Lt. A S. 21, single. Oct. 3, 1918.

History:

Smokes ten cigarettes a day.

Wore glasses five years ago for study.

Feels sick most of the time. Fatigued constantly.

Eye: V. both 20/15—1, Pd. 65 mm.

Exam.: N. P. C. 55 mm. N. P. A. R. 115 mm. L. 115 mm. 6 meters:—Ex. 2°. Divergence 6°. Convergence 18°.

Muscles: 25 cm.: Ex. 14°. Divergence 20°. Convergence 40°.

Oct. 11, 1918: Right blind spot enlarged. Fig. 1.

Diagnosis: Retrobulbar congestion R.

Ear: Negative.

Nose: Negative.

Throat: Chronic tonsillitis.

Dental: Dental X-rays negative. Lower right wisdom tooth not fully erupted but not causing trouble.

Medical: Fainting spells.

Neurologic: Anxiety neurosis.

Laboratory: Negative.

Treatment:

Oct. 12, 1918: Tonsillectomy. Considerable edema in soft palate following operation.

Oct. 18, 1918: Rt. blind spot larger.

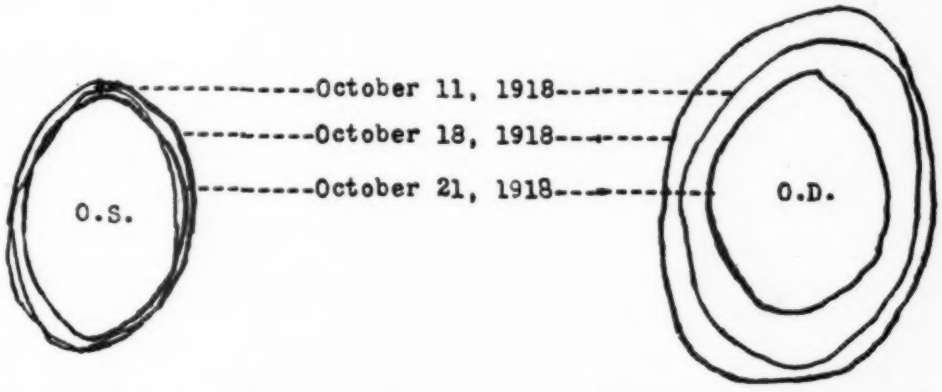

Fig. 1. The blind spots of the right and left eyes as recorded at successive dates by the rapid clinical method described above. Note increase in size of right blind spot following tonsillectomy; left blind spot also slightly enlarged at this time.

Oct. 21, 1918: Throat healed. Blind spot normal. Headaches improved.

Result:

1. Ocular condition improved.

2. Headaches and general physical condition improved.

3. Class B. Anxiety neurosis.

CONCLUSIONS: 1. The blind spots are frequently enlarged in nose and throat infections seemingly before vision or other ocular functions are affected.

2. Repeated examinations of the blind spots in nose and throat infections give information as to the efficacy of treatment and often show the need for more radical measures.

3. Fliers who are receiving treatment for focal infection should have their blind spots examined routinely.

VISUAL ACUITY.

In answer to the third question concerning visual acuity our records revealed that two of the thirty-eight pilots with nose and throat infections had diminished visual acuity which could only be partially corrected by lenses. The case histories of these two officers appear in detail above. Case 2, L. W. B. and case 4, J. C. K. Both complained of periodic blurring of vision, photophobia, and pain back of eyes. The vision of one, L. W. B., was slightly improved and the size of the blind spots reduced by resection of the nasal septum followed by local nasal treatment. The vision of J. C. K. became worse and the blind spots larger, following tonsillectomy and adenectomy. The blurring of vision was very troublesome and at times made it difficult for them to judge distance in landing.

Conclusion 1. The periodic blurring of vision in nose and throat infections is sufficiently common to be the cause of an occasional crash.

Conclusion 2. Pilots suffering from nose and throat infections should not be permitted to fly, particularly when there is any enlargement of the blind spots.

In answer to the 4th question it was found that ten of the thirty-eight pilots with nose and throat infections had affections of extraocular muscles, divided as follows:

EXTRAOCULAR MUSCLES.

Convergence weakness, nine pilots. Only one case of the accommodative type of convergence insufficiency was encountered in the examination of 794 pilots. This was probably due to the fact that few of the fliers wore correcting lenses and uncorrected myopes were rare.

1. E.M.S. 2nd Lt. 21-3. Single. October 19, 1918.

C.C. Nauseated. Sick of air.

F. H. Negative.

P. E. H. Never has worn glasses nor has had any trouble with eyes.

H. P. T. Has cold in head.

Phys. Exam.: V. R. 20/15—4. L. 20/15—2. H. M. .62 S 20/15, Pd. 62 mm. N. P. A. 118 mm. H. M. .25 S 20/15 N.P.C. 105 mm. 102 mm.

Muscles: 6 M. Es. 1, Div. 6.° Conv. 13°. 25 cm. Ex. 5, Div. 25° Conv. 35°.

Diagnosis: Convergence weakness.

Ear: Negative.

Nose: Acute rhinitis.

Throat: Pus in both tonsils.

Dental: Negative.

Medical: History of being sensitive to motion.

Neurology: Negative.

Psychology: Negative.

Laboratory: Negative.

Course and Operation: Tonsillectomy. Converging exercises.

Result: Improvement of converging power.

2. R. C. October 12, 1918.

History given under Case 1 R. C. in retrobulbar neuritis group. Nose and throat diagnosis; infection of posterior ethmoids and sphenoid sinus. Diagnosis: Convergence weakness. See Fig. No. 2.

Result: Converging power improved after resection of septum and converging exercises. Continued training as pilot.

3. W.C.A. 24-9. Single. October 8, 1918.

C. C. Tired out. Feels stale.

F. H. Negative.

P. M. H. Negative.

P. E. H. Negative.

H. P. I. Feels stale and tires easily.

Phys. exam.: Eye. V. R. 20/10—3 N.P.C. 65 mm. L. 20/15+4 N.P.A. 96 mm., 94 mm.

6 M:—Ex. 2° Div. 8°, Converg. 16° 25 cm. Ex. 12°. Div. 22°, Convergence 27°.

Diagnosis:

Eye:Convergence weakness.

Aural and nasal: Negative.

Throat: Hypertrophied tonsils filled with pus.

Dental: Pyorrhea.

Medical: Negative except tonsils.

Neurologic: Negative.

Laboratory: Negative.

Course and operations: Tonsillectomy and exercises.

Result: Was permitted to fly but returned for converging exercises.

4. C.E.B. November 4, 1918.
F.H. Negative.
P.H. Chronic rheumatism (artic.). Tonsillitis in childhood.
P.E.H. Eyes always good.
H.P.I. No trouble.
Phys. Exam; Eye: V. R. 20/15 L. 20/15. N.P.C. 80 mm. Muscles 6 M. Ex. 2°, Div. 4°, Con. 7°. Blind spots normal.
Diagnosis: Convergence weakness.
Dec. 2, 1918.
N.P.C. 65 mm. 6 M. 1½° Ex. Div. 3° Converg. 9.° 25 cm. Ex. 12° Div. 4° Converg. 11.°
Ear: Negative.
Nose: Negative.
Throat: Septic tonsils—surface burned by frequent applications of silver nitrate.
Dental: Negative.
Medical: History of tonsillitis and rheumatism.
Course and treatment: Operation, tonsillectomy.
Result: Improved—Class A.
5. J. W. C.
C.C; Lost feel of air.
F.H. Negative.
P.H. Negative.
P.M.H. Headaches.
P.E.H. Negative.
Phys. Exam: Eyes V: R. 20/15. 6 M. Ortho. Div. 7°, Conv. 8°. L. 20/15 25 cm. Ex. 12° Div. 20°, Conv. 16°.
Diagnosis: Convergence weakness.
Ear: Negative.
Nose: Irregular septum.
Throat: Pus in both tonsils.
Medical: Heart rapid after exercise (toxic).
Course and Operation: Tonsillectomy.
Result: Improved.
Keen to continue flying.
6. H.F.M. 27-3. Single. September 27, 1918.
C.C. Feels tired out.
F.H. Negative.
P.H. Negative.
P.E.H. Wore glasses 1 year for reading when 8 years old.
H.E.I. Feels nervous.
Phys. Exam. Eyes: R. 20/15 N.P.C. 49 mm. N.P.A. 98 mm. L. 20/15. 6 M. Div. 7° Conv. 8° 85 mm. 25 cm. Ex. 10° Div. 12°, Con. 17.°

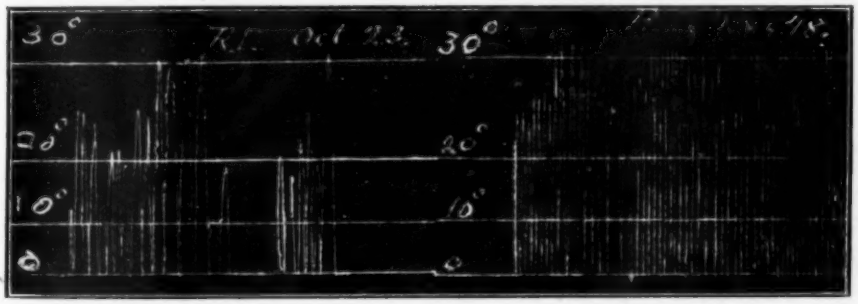

Fig. 2. Two records of the fatigue of convergence of Lt. R.C. are recorded by the modified Howe's ophthalmic ergograph. The time is recorded in ½ minutes. The horizontal lines correspond to ten, twenty and thirty prism degrees and are so marked. Note the increase in strength of the convergence power between October 23, 1918, and November 4, 1918.

Diagnosis: Convergence weakness.
Ear: Negative.
Nose: Negative.
Throat: Chronic follicular tonsillitis.
Dental: Negative.
Medical: Tired out.
Neurology: Stale.
Course and operation: Tonsillectomy and converging exercises.
Result: Developed arthritis. Class B, Arthritis.
7. L.C.R. 22-10. Single. October 25, 1918
C.C. Influenza.
F.H. Negative.
P.M.H. Children's diseases.
P.E.H. Negative. H.P.I. Headaches occasionally.
Phys. Exam. Eyes: V. R. 20/15 Pd. 70 mm. N.P.A. 125 mm. N.P.C. 90 mm. N.P.A. 125 mm. 6 M. Div. 5°,

Conv. 9°. 25 cm. Ex. 4° Div. 20°, Conv. 11°.

Diagnosis: Convergence weakness.

Ear: Negative.

Nose: Congestion.

Throat: Septic tonsils.

Dental: Negative.

Medical: Had influenza and now has acute rhinitis.

Course and treatment: Tonsillectomy and converging exercises. Dec. 2: Eye exam. No improvement.

N.P.C. 105 mm. 6 M. Ortho. Div. 4°. Converg. 9°. 25 cm. Ex. 13° Div. 20, Converg. 12.

Result: Much improved generally. Convergence weakness unimproved.

8. A.H.Y. 22-5. Single. October 3, 1918.

C.C. Negative.

F.H. Negative.

H.P.I. O.K.

Phys. Exam. Eye: V. R. 20/10—2 Pd. 63 N.P.A. 100 mm. L. 20/15—4 NPC 56 mm. N.P.A. 108 mm.

Diagnosis: Convergence weakness. 6 M. Ex. 1° Div. 4°, Conv. 16°. 25 cm. 17° Ex. 17° Div. 27°, Con. 36°.

Ear: Negative.

Nose: Deviation high up to right blocking drainage. Mucopus in nares.

Throat: Negative.

Dental: Negative.

Medical: Discharge from nose.

Laboratory X-ray: Frontal and antrum right.

Course and treatment: Antral puncture and irrigation. Pus in antrum. Pus in nasal slit after antrum cleaned. Converging exercises.

October 8, 1918: N.P.C. 35 mm 6 M Div. 4°, Converg. 35 mm. 25 cm. Div. 12°, Conv. 63°.

Result: Ocular condition improved. Removed from flying—Pansinuitis.

9. G.M.T. 22-6. Single. September 28, 1918.

C.C. Feeling of fullness in right ear and heaviness of right eye.

F.H. Negative.

P.H. Fatigues easily.

P.M.H. Diseases of childhood.

P.E.H. Wore glasses 2 years for reading. Granular lids before wearing glasses.

H.P.I. Eye troublesome since May. Chest trouble from pneumonia.

Phys. Exam. Eye: R. 20/10—1 H.M. +75s 20/10—1 Pd. 65 mm. NPA 100 mm. L. 20/15—1 H.M. +75s 20/15—1 NPC 84 mm. NPA 105 mm.

Diagnosis: Convergence Weakness. Hypermetropia. 6 M. Div. 5°, Conv. 8°. 25 cm. Ex. 17°, Div. 20°, Conv. 23°.

Diagnosis: Convergence Weakness. Hypermetropia.

6 M. Div. 5° Conv. 8°. 25 cm. Ex. 17° Div. 20°, Conv. 23°.

Ear: A. D. Chronic catarrhal otitis media—eustachian tube closed.

Nose: Deviation high up to right.

Throat: Pus in both tonsils.

Medical: Negative.

Course and treatment: Tonsillectomy—Converging exercises.

Oct. 18. N.P.C. 53 (Jerky) 6 M Divergence 5°, Convergence 12°. 25 cm. Divergence 16°, Convergence 32°.

Conclusion: Converging power improved. Hearing normal.

DIVERGENCE EXCESS CONVERGENCE INSUFFICIENCY.

1. G. S. H. Sgt. 21-8, Single.

Sept. 24, 1918.

C.C. Negative.

F.H. Negative.

P.M.H. Devitalized teeth but root canals filled.

P.E.H. Negative.

H.P.T. Negative.

Phys. Exam. Eyes: R. 20/20—4 R. +.50 ⌒ +0.62 cyl. ax. 100°=20/20. L. 20/20—2+.75 ⌒ +.25 cyl. ax. 90°=20/20.

H.M.R. .50s 20/15 Pd. 64 mm. N.P.A. 115 mm. L. .50s 20/15 N.P.C. 40 mm.

Diagnosis: Divergence excess with beginning convergence insufficiency. Ex. 2° 6 M. Div. 9°, Conv. 16°. 25 cm. Ex. 9°. Div. 25°, Conv. 25°.

Ear: Negative.

Nose: Negative.

Throat: Chronic tonsillitis.

Dental: Negative.

Medical: Negative.

Course and treatment: Oct. 4, 1918

—Tonsillectomy. Converging exercises.

Result: Improved.

INTRAOCULAR MUSCLES.

Only three of the thirty-eight pilots showed any affection of the intraocular muscles.

R.C. (Case one, retrobulbar neuritis). Rt. iris dilated. Accommodation unaffected.

L.W.B. (Case 2, retrobulbar neuritis). Rt. iris dilated (recent). Accommodation unaffected.

J.C.K. (Case 4, retrobulbar neuritis). Marked weakness of accommodation but irides unaffected. Accommodation weaker after tonsillectomy.

The near point of accommodation and convergence is measured in millimeters from the anterior surface of the cornea. This method has proven least confusing and permitted the accurate recording of small changes. If the wearing of lenses necessitated measuring from the anterior focus of the eye, 13mm. was taken from findings. Exercises for accommodation and convergence were given on Howe's Opthalmic Ergograph modified for our purposes.

CONCLUSIONS.

1. Many of the pilots who showed little weakness of converging power as measured by the near point of convergence and prism converging power, showed rapid onset of fatigue when tested on the Ergograph. The same was true of accommodation, only fewer men were examined for fatigue of accommodation.

2. Our experience leads us to believe that weakness and rapid onset of fatigue of the extra- and intraocular muscles is frequently associated with nose and throat infections and that this subject is worthy of further study.

3. Weakness in the converging power was often associated with bad landings. Whether this was due to derangement of binocular vision or to the general disturbance associated with the convergence weakness is a problem for further research.

The fifth question may be answered by giving a résumé of the histories and physical examinations of the thirty-eight pilots.

Twenty-eight had complaints of varying degree.

Six complained of cold in the head.

Six, of headache.

Two, of constipation.

Eleven felt tired out and were ambitionless.

One had stomach trouble.

Two complained of recurring attacks of tonsillitis.

Physical examination showed:

Four with bronchitis.

Six, tonsillitis, chronic.

Seven showed signs of staleness.

This entire subject needs thoro investigtaion by a group of medical men trained in aviation medicine, and if this paper brings forth constructive criticism and intelligent research, it will have served its purpose.

EYE LESIONS PRODUCED BY LIGHT RICH IN ULTRAVIOLET RAYS. SENILE CATARACT, SENILE DEGENERATION OF MACULA

J. VAN DER HOEVE,

LEYDEN, HOLLAND.

This paper reviews the observations made by its author and others, and the arguments that have been published bearing upon the influence of ultraviolet rays upon the eyes. He explains how light, falling upon the lens, may exert its unfavorable influence upon the ciliary processes, by the dispersion of short-wave light because the lens is optically heterogeneous; and brings out the point that senile cataract may have an influence in preventing pathologic changes in the macula.

Undue exposure to light, either natural or artificial, is a factor in the causation of many disorders of the eye. According to Hertel[1] every kind of ray can cause damage to the eye, if only the intensity is great enough. Of the different parts of the spectrum which can cause disease, the infrared rays have been least studied. Vogt[2] attributes to them the causation of glass workers' cataract. The visible rays are generally considered to be the cause of eclipse blindness. The effect of the ultraviolet rays on the eye is that which has been the most studied, especially in the last fifteen years.

In experiments it is very difficult to work with ultraviolet rays only, and exclude all others; but far more difficult to distinguish the effects in natural light of light rays and ultraviolet rays. Hence it is better to speak of light rich in ultraviolet rays, as Parsons[3] does.

For literature on this subject the reader may be referred to the excellent reports of Hess[4] and J. H. Parsons on the Affections of the Eye Produced by Undue Exposure to Light; and to Wagenmann[5].

When we consult these authors as to the parts of the eye which may be damaged by exposure to light of short wave length, we find that scarcely any part of the eye is absolutely protected.

Not all the ultraviolet rays, which fall on the eye, are transmitted; the different media absorb a great part of them. Numerous experiments have been carried out to determine the absorptive capacity of the various structures of the eye for ultraviolet rays; and tho the results of Brücke[6], Donders[7] and von Reuss[8], de Chardonnet[9], Widmark[10], Schulek[11], Hertel[1], Schanz and Stockhausen[12], Birch Hirschfeld[13], Hallauer[14], Vogt[2], Parsons[4], and others are somewhat discordant, we know from them with certainty that the cornea and lens in particular partially absorb the ultraviolet rays.

Nearly all authors speak of the diminishing of rays in passing thru a medium as having been caused by absorption. This is not correct, there are other causes besides absorption that make the media partially impenetrable. We shall speak of this later.

HARMFUL LIGHT.

According to Parsons the researches on this subject by Martin are the most accurate hitherto published. Martin's[15] experiments show us that the cornea absorbs all rays beyond 295$\mu\mu$ completely and has no absorptive capacity of rays of greater wave-length; whereas the lens completely absorbs all rays beyond 350$\mu\mu$. The line is not a sharp one, absorption commencing about 400$\mu\mu$. Tho Parsons is very absolute on this point, one must bear in mind that experiments of Hallauer, Birch-Hirschfeld, Schanz and Stockhausen and others showed that the absorption of the lens has many individual differences; connected with eye, constitution, and other not exactly determined influences, thickness, color, and consistency of the lens.

Whereas there are lenses which beyond 400$\mu\mu$ absorb completely, Hallauer found youthful lenses which transmitted rays of 310-330$\mu\mu$, and

Schanz a juvenile lens, which transmitted rays from 300$\mu\mu$ upwards.

From these results, we know that, when ultraviolet rays fall on our eyes:

The surface is reached by rays of every possible wave length.

Iris and lens by rays from 295$\mu\mu$ upwards, the retina as a rule only by rays from 350$\mu\mu$ upwards; in some cases from 300$\mu\mu$, in others 400$\mu\mu$ upwards.

To discover what damage light, rich in ultraviolet rays, causes to the different parts of the eye, we may follow two methods viz: to find from literature what affections of the human eye have been caused by such light, and to experiment on animals.

As a typical instance of the effect of natural light rich in ultraviolet rays on the human eye there is the well known snow-blindness. As sources of artificial light of this kind, which can damage the eye, arc lamps, mercury-vapor lamps, electric-welding, short circuit flashes are noted. The changes by lightning are generally attributed to other causes.

AFFECTIONS DUE TO LIGHT.

The first affection which human eyes suffer from natural and artificial sources of light rich in ultraviolet rays is photophthalmia, a name given by Parsons to these inflammatory conditions of the superficial part of the eye that are produced by exposure to various forms of bright light. In general, it is characterized by intense photophobia and lacrimation, with often blepharospasm and ciliary neuralgia. There is acute conjunctivitis and in the severest cases the cornea and iris may be implicated in the inflammation.

As a rule we attribute this inflammation of the superficial parts of the eye to the shorter waved radiation, whereas the affection of the inner eye is caused by the longer waved ultraviolet rays and the light rays. This difference is probably the cause of the two different kinds of snow-blindness, that we distinguish (Wagenmann): one with preponderance of the external diseases of the eye, the other with preponderance of the internal diseases of the eye, which may be found separate or together, according to the presence of ultraviolet rays of shorter or longer wave length or of both.

We find described caused by light sources rich in ultraviolet rays:

Photophobia, lacrimation, ciliary neuralgia.

Of the eyelids: erythema, spasm, edema.

Of the conjunctiva: changes of the epithelium, hyperemia, edema, chemosis, ecchymosis, injection, inflammation.

Of the cornea: haziness, opacities, infiltrations, ulcer.

Of the iris: hyperemia, change of color, pupillary contraction, inflammation.

Of the ciliary body: tenderness of the ciliary region.

Of the disc: hyperemia, inflammation, paleness of the temporal part.

Of the retina: scotoma, especially central scotoma, whitish spots at the macula, chorioretinal changes, constriction of retinal arteries, dilatation of the veins.

From experiments with light rich in ultraviolet rays, according to the publications of Widmark,[10] Hess,[4] Birch-Hirschfeld,[13] Martin,[15] etc., the same affections are found in animals.

Moreover Widmark, von Hess, and others observed in some animals slight opacity of the lens and microscopic changes in the anterior capsule cells; this lens damage was confined to the pupillary part of the lens. Birch-Hirschfeld found that the posterior layer of the iris could be seriously damaged and that the ciliary processes showed hyperemia, hemorrhages, swelling and desquamation of the epithelium, inflammation with fibrinous exudation in the anterior and posterior chambers. The inflammation of the eye was especially developed in the ciliary processes, the choroid showed hyperemia. In the retina Birch-Hirschfeld found degeneration especially when the eyes were aphakic. We see from all this, that nearly every part of the eye can be damaged by light rich in ultraviolet rays.

DANGEROUS EXPOSURES.

We know that in sunlight and in diffuse daylight many ultraviolet rays are present, especially those of a wave length between 300 and 400$\mu\mu$. Moreover in the last twenty-five years the range of rays emitted by our artificial lights contains more ultraviolet rays than formerly. Consequently during the whole day, at least as long as our eyes are opened, they are irradiated by light rich in ultraviolet rays (sunlight, diffuse daylight, artificial light), therefore the fear is justified that this may damage our eyes.

We saw that sunlight and artificial light can in certain circumstances damage our eyes; how does it stand with diffuse daylight?

Hertel and Henker[16] say diffuse daylight is innocuous to the eye. They write about "the undoubtedly innocuous daylight"; and they criticize Schanz and Stockhausen because they declare in a publication that snow-blindness is caused by daylight. Whereas according to Hertel and Henker, diffuse daylight, whether it comes from the light of the blue sky, or reflected from the clouds, or light which reaches us from a covered sky on dull days, cannot cause this affection. They consider as axiomatic, that diffuse daylight is innocuous.

This axiom, however, cannot be maintained, because Daland[17] recorded in 1917 that the Eskimos on the coasts of Alaska, Siberia and the islands of the Bering Sea, and Arctic Oceans suffer very much from snow-blindness even on cloudy or dull days. "Many Alaskan pioneers have suffered snow-blindness by dispensing with goggles, under the conditions, believing that they were safe as long as the sun was hidden by clouds." One of Daland's conclusions is: "Snow-blindness occurs on cloudy days, on dark days, as well as on sunny days."

Even if it had not been found that diffuse daylight can cause snow-blindness, still we could not pretend with Vogt and Hertel and Henker that the ideal lights are those whose intensity is no stronger than the intensity of diffuse daylight; and ideal goggles those that diminish the light so that the transmitted light is not brighter than diffuse lighted clouds. When in winter time the day lasts eight hours and we work eight hours longer by artificial light, even tho this light is not brighter than diffuse daylight, we expose our eyes twice as long to the light as nature meant us to do, and it is not impossible that a short exposure is not harmful to the eye, whereas prolonged exposure might be.

But the experience of the Eskimos is itself sufficient to prove that diffuse daylight may damage the eyes, so that light sources and goggles cannot be called ideal, which make the light equal to diffuse daylight.

If daylight can damage the eye, the next question is, which affections can be caused? Dr. D. Neuman of Nome, Alaska, found very often among Eskimos suffering from snow-blindness, chorio-retinitis, which according to Daland might be caused by the ultraviolet rays. The Eskimos, according to Daland, show conjunctivitis, cataract, trachoma and snow-blindness as "common ocular diseases." The conjunctivitis and snow-blindness may be caused by the ultraviolet rays; with regard to cataract it is an open question whether it can be caused by ultraviolet rays.

CAUSATION OF CATARACT.

The question whether senile cataract can be connected with the influence of daylight on the eyes is often raised and is a highly interesting point. In the newer literature we find several publications about this:

Hirschberg[18] records in 1898 that in India senile cataract becomes mature about 20 years earlier than in Europe. Whereas in his clinic in Berlin cataract comes to operation on an average at the age of 62 years. He saw in the hospitals of Calcutta, Jaipore, Bombay, that Hindus were operated for senile cataract about the age of 46 years or some years later. Hirschberg attributes this early maturity of the cataract to the heat of

the sun; but of course it may just as well be attributed to the other rays of the sun. Against this experience of Hirschberg, Hess quotes Snell[19], who, according to Hess writes on the authority of statistics given to him by Brockman, that in India cataract is not earlier than in Europe. When, however, we read Snell's paper itself, we see that he only writes, that the particulars given by Brockman hardly bear out the statement made by Hirschberg, but when we read Snell's article more carefully we can hardly agree even with this verdict.

Snell agrees with Hirschberg on the age of the cataract patients who come to operation in Europe: Hirschberg found in Germany an average of 62 years for senile cataract, Snell found about the same age, even in bottlemakers.

Brockman gave to Snell the following statistics about the age at which he operated cataract in India:

Age	Males	Females	Total
21 to 30	99	59	158
31 to 40	309	298	607
41 to 50	872	893	1765
51 to 60	1225	782	2007
61 to 70	503	168	671
	3008	2200	5208

We see most extractions were done at the age of 41-60 years on an average of about 50 years. Snell gives some figures about his own cataract extractions in England. When we compare Snell's figures to those of Brockman and omit the age of 21-30, because this cannot be reckoned as senile cataract, we find:

Brockman (India)				Snell (Sheffield)		
Age						
31-40	607	12%		47	9%	
41-50	1765	35%	75%	67	13%	
51-60	2007	40%		159	31%	78%
61-70	671	13%		237	47%	
	5050			510		

We see, that in Snell's statistics the age of operation is in 78% between 51 and 70 years, by Brockman in 75% between 40 and 60. Whereas in Snell's statistics the decennium 61-70 contains 47 of the 78=60.25%, in Brockman's statistics the decennium 51-60 only 40 of the 75=53%; consequently we can draw from the two sets of statistics only this conclusion that in India, in the region where Brockman operated, senile cataract comes to operation more than 10 years earlier than in Sheffield. Snell tries to explain this fact by the earlier maturity and short lives of the Indian natives, but the fact remains that in India cataract is earlier than in Europe.

We see that Brockman's statistics verify the statement of Hirschberg, that in India cataract comes much earlier to operation than in Europe. Last year I found an article of T. J. Walter[20] of Florida in which the following passage appeared: "Cataracts are much more common the nearer the equator we go; and it has been proved that light is a factor in the production of this." I regret I could not obtain the paper in which Walter proves this fact (a paper read by the author before the Florida Medical Association 1915).

Hirschberg found in his clinic senile cataract much more frequent in country people at 50 years of age than in town people. Schwitzer[21] found from 3674 cases of senile cataract, which were treated from 1875 to 1896 in the Budapest University Eye Hospital, that cataract appears most in country people, especially in the lower parts of Hungary. Schwitzer thought this fact proved that as Widmark could provoke lens opacities, by means of ultraviolet rays, so came cataract.

Birch-Hirschfeld points out, that Schwitzer quotes the literature badly and that he has no right at all to compare the opacities, which Widmark provoked, with senile cataract; because that is a quite different thing. Birch-Hirschfeld is quite right in this, but that does not diminish the value of the statistics of Schwitzer.

Schulek quotes very interesting figures of Grosz, who, according to Schulek in a pioneer article, showed in 1858 that in lower Hungary cataract was very frequent, especially among the people who worked in the

fields. In the regions where women worked in the fields just like the men, cataract was as frequent in women as in men, whereas in other regions where women did not do field work in the rays of the sun, and especially the ultraviolet rays, cataract is much more frequent among men than among women. Schulek comes to the conclusion, that light and especially ultraviolet rays are a prominent factor in the origin of cataract.

Against Schwitzer and Schulek, Birch-Hirschfeld says, and according to Hess he is right, that if ultraviolet rays cause cataract, people who live in high regions would have more cataract than other folk, and this as far as is known is not the case. This objection is not valid. Light certainly in the mountains contains more ultraviolet rays than in lower regions because the diffusion of light is less in the higher regions. But this increase of ultraviolet rays is greater for the rays of shorter wave-length, than for those of longer wave length; and we know that the first cause irritation of the eye and photophthalmia, so that the eyes must be kept more closed or be protected by goggles, in both cases the number of rays which reach the lens will be diminished.

Ascher[22] found out in the University eye clinics of Prag and Strassburg that patients who had more cataract in one eye than in the other, had worked so that the light had influenced one eye more than the other.

When we consider the results of our inquiry into the literature on the subject, we see that whereas the opposition of Snell, Birch-Hirschfeld and Hess is not justified; Grosz[23], Hirschberg, Schwitzer, and Schulek found out that cataract is more common, and appears earlier in country people than in town people, in Hungary as well as in Germany; that according to Hirschberg and to Brockman, cataract maturity is 10 to 20 years earlier in India than in Germany and England; that Daland calls cataract a common ocular disease in Eskimos in the snow and ice fields of Alaska and Siberia; that according to Walter cataract is much more common in America the nearer the equator we go, and that Asher was able to observe the influence of the position of the working lamp on the appearance and development of cataract.

If all this material came from the same part of the world, we might be tempted to think that diet, racial peculiarities, etc., were the cause of the earlier and more frequent appearance of cataract, but since these reports come from all parts of the world: Alaska, Siberia, India, Hungary, Berlin, Florida; these circumstances cannot be of great influence, and we look for a cause common to all these regions, and find it in the presence of more ultraviolet rays in the light of these regions than in others.

Hess, who thinks we have up to now insufficient evidence, to conclude that ordinary daylight damages the sound or diseased eye, writes moreover, "but from general biological motives—I could not readily conclude that in a living organ which has developed phylogenetically under the constant influence of daylight, the inconvenient peculiarity has developed itself of being seriously damaged by this same daylight." This is not a proof but a personal opinion to which I have some objections.

In the first place: What is daylight? In our part of the world it is mostly a diffuse relatively little reflected light; for the Eskimos it is a light very much reflected on the snow surface, sometimes sunlight, sometimes diffuse light; at the equator it is sunlight. The last mentioned lights can damage the eye seriously as we know from snow-blindness and sun-blindness.

Moreover, one of the chief reasons why an organ which develops under a certain influence will not be damaged by this influence is this that the individuals who have more sensitive organs will be less fit for life than the individuals with stronger organs, so that the latter will survive—"the survival of the fittest." For the origin of senile cataract, however, this is of no importance, because the cataract only appears at an age when the individuals

as a rule do not produce progeny any more, and when the working force is already diminished by other causes. Therefore a natural selection of individuals who are not apt to get cataract will not take place.

So tho we agree fully with Hess, that exact statistics composed from uniform points of view on the relative frequency of senile cataract in different countries will be of high interest, and will probably answer the question, we we must point out that the facts now known show plainly that senile cataract is more frequent and appears earlier in regions and countries which are more exposed to light rich in ultraviolet rays, and in people who expose themselves to this light.

We must always remember that even if light is a factor in the origin of cataract it is only one of a great many factors, which act on the whole organism or on the eye alone; that light is a principal factor in the origin of senile cataract is, however, rendered highly probable by the above mentioned facts. If this is true, the next question is: How is it possible that light, rich in ultraviolet rays, damages the lens so that senile cataract ensues?

HOW LIGHT ACTS.

In experiments by Widmark, Birch-Hirschfeld, von Hess, Martin, regarding the influence of ultraviolet rays, lenticular opacities were in some cases obtained with changes in the anterior capsule cells, the damaged area being restricted to the pupillary parts of the lens. In other experiments of Birch-Hirschfeld, Martin, Hertel, Ogneff[24], Strebel[25], could obtain no changes in the lens.

The opacities obtained have nothing to do with senile cataract, which almost never begins in the pupillary part. They only prove, that just like the epithelium of conjunctiva and cornea, the capsular epithelium too may be damaged directly by relatively short exposure to extremely strong light, rich in ultraviolet rays. Chardonnet and Widmark think that the exposed part of the lens must suffer as a consequence of the absorption of so many rays.

Schanz[26] proposed the theory, that the albumin of the lens is changed by ultraviolet rays from easily soluble to less soluble, which change makes the lens opaque. He explains the fact that in senile cataract, the whole lens becomes opaque by the inner diffusion of rays in the lens. But even if this is possible the commencement of the opacity must, according to this theory, be in the pupillary part which we know is not as a rule the case in senile cataract.

Every attempt to explain the cause of senile lens opacity by the immediate influence of light, rich in ultraviolet rays, fails because those rays only reach the lens in the pupillary part of the lens, and the senile cataract does not begin at that place. Therefore for the explanation of the connection between senile cataract and lighting we have to accept next to the direct damage of the lens an indirect one. When we look for some cause of indirect injury of the lens our thoughts turn to the ciliary body on which the lens is dependent for its nutrition; very little disturbance of the ciliary processes only is necessary to cause changes in the lens.

In 1912[27] I put forward an hypothesis of how it is possible for the ciliary body to be damaged when the eye is exposed to light, especially when this is rich in ultraviolet rays; and stated the theory then that in such a way this light could cause senile cataract. That the ciliary body can be damaged and even seriously damaged by light, rich in ultraviolet rays, is a fact. In snow-blindness the ciliary region shows tenderness, when we touch it, and the patients suffer from severe ciliary neuralgia. In ophthalmia electrica we find the same symptoms, whereas in experiments on animals Birch-Hirschfeld found an inflammation of the ciliary processes, which was especially developed. He found desquamation and swelling of the epithelial cells, fibrinous exudation in anterior and posterior

chamber, hyperemia and hemorrhages in the processes.

Parsons,[3] who experimented with Henderson and Martin, found with the delicate test which Römer[28] showed for disturbance of the fixation of the ciliary processes, that they became dis-

Fig. 1.

Fig. 1. Effect of search light in air free from dust, optically homogeneous.

turbed when the eye was exposed to light, rich in ultraviolet rays. If they exposed the eyes of immunized guinea pigs or rabbits, to the light of the uviol or Kromayer mercury vapor lamp, they found that hemolysins were transmitted to the aqueous. Parsons (1913) concludes therefore that there is some reason to think that interference with the nutrition of the lens, thru the ciliary body by ultraviolet rays, may be a contributory cause in the genesis of glass workers' cataract.

So we see that by natural light, as well as by artificial light rich in ultraviolet rays, and in experiments with light of this kind the ciliary processes are damaged, but how is this possible? We know that the ciliary processes lie exceedingly well protected from the influence of light, from the anterior side by cornea and iris, from the exterior side by conjunctiva, sclerotic, the muscular part of the ciliary body, and the pigment layer. Even so well protected that Fuchs[29] declares: "The ciliary body is not reached by light." To explain a reason why it is possible that the ciliary processes are damaged by ultraviolet rays, I have to refer to researches which I made in 1911 and 1912 on optical qualities of the lens. I showed then that the lens is optically heterogeneous not homogeneous.

THE LENS NOT HOMOGENEOUS.

We understand by the optical heterogeneity of a substance the fact that in this substance are present small particles, which when light falls upon them, become light sources themselves and disperse the light on all sides without changing the wave length of the light. As they are the particles of the substance itself but a kind of stain, we speak about substances which are optically homogeneous as optically pure or optically empty substances.

In the lens it seems a most illogical quality to be optically heterogeneous; not only because the diffused light is not used for the image on the retina but because it is also diffusely spread through the whole eye, so that the image in the retina may be blurred. It seems so irrational, that even well known physiologists consider it axiomatic that the lens is optically empty. Notwithstanding this, the lens is optically heterogeneous.

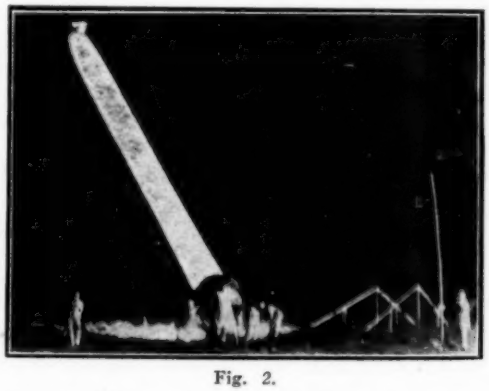

Fig. 2.

Fig. 2. Effect of searchlight when air is optically heterogeneous. Beam of rays revealed by light diffused in all directions.

Optically heterogeneity is known to every one, because in nature we find scarcely any substances which are optically homogeneous. It is best known by the fact that a sunbeam falling through a narrow slit into a dusty room can be seen from every side, be-

cause every particle on which the light falls, spreads the light on all sides, so that the track of the light is mapped out by the brilliant illumination of the dust or motes that are always present in a room.

If, for instance, the air was optically homogeneous, had no internal diffusion we would see of a searchlight only the light in the place where it is made and the reflection of the light on objects which are illuminated by it. Compare for instance Fig. 1, where we see the searchlight and an aeroplane.

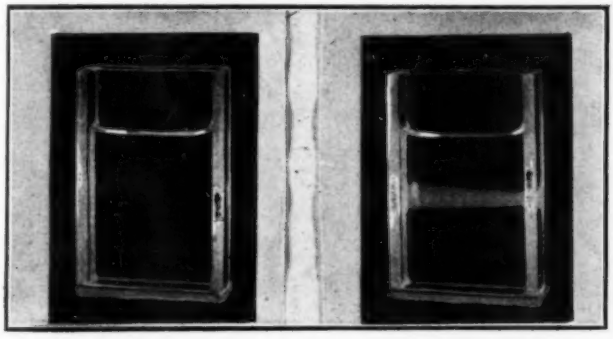

Fig. 3.

Fig. 3. Light passing thru homogeneous medium path not seen.

The air, is however not at all optically homogeneous; therefore we do not see Fig 1, but Fig. 2; the whole track of the light in the air being mapped out as a luminous band, because every particle in it, disperses the light to every side. All the light effects in the air from searchlights, semaphores, etc., are caused by the optical heterogeneity of the air.

When we have to examine a substance for its homogeneity we send thru it a bundle of light-rays. When the sunshine itself remains dark (Fig. 3), we know it to be optically pure, homogeneous; if a luminescence appears (Fig. 4), it may be optically heterogeneous. This luminescence is called the Tyndall phenomenon in honor of its discoverer.

If we send thru an animal or human lens a bundle of light rays, we observe a very strong luminescence, independent of the direction in which we let the light traverse the lens, in frontal (Fig. 5a) vertical (Fig. 5b) or sagittal (Fig. 5c) direction. Have we now the right to declare the lens is optically heterogeneous? No, because this luminescence can also be caused by fluorescence. To prove therefore that the lens is optically heterogeneous or homogeneous, we must distinguish fluorescent light from diffuse light.

As we know, fluorescence is the quality of a substance that every part of the substance becomes, if light falls on it, a source of light itself which

Fig. 4.

Fig. 4. Light passing thru heterogeneous medium showing its path, so-called Tyndall phenomenon.

spreads the light on every side. In contrast to diffuse light the wave-length of the fluorescent light is different from the wave-length of the light which causes the fluorescence. Most substances follow Stoke's rule that the wave length is increased by fluorescence, some other substances on the contrary diminish the wave length of the light.

It is a well known fact that the lens shows a very strong fluorescence, which follows Stoke's rule and increases the wave length of ultraviolet, violet and blue rays to a whitish blue. Thence the luminescence in Fig. 5 will be at least partly caused by fluorescence. A great difference between diffuse light and fluorescent light is that diffused light is partly polarized, fluorescent light is always natural light, at least in substances which are not birefringent.

In certain circumstances as lens fi-

bres can be birefringent, therefore we have in the first place to decide whether the fluorescent light of the lens is natural or not. We can do this by causing fluorescence by means of dark rays. We can either take a Lehman's filter, which absorbs all the light rays and transmits only the ultraviolet rays, or we can divide the light by quarter prisms in its spectrums and

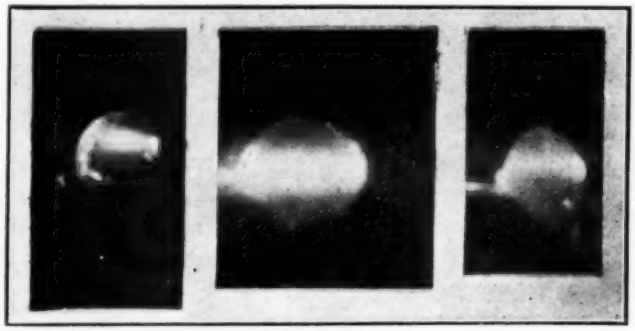

Fig. 5a. Fig. 5b. Fig. 5c.

Fig. 5. Beam of light passed thru crystalline lens in dffierent directions. Its path is shown by the diffused light, proving that it is optically heterogeneous.

place the lens in pure ultraviolet. By one of these means the lens is traversed by ultraviolet rays only. If we now get a luminescence it is fluorescence only, because this has increased the wave length of the dark ultraviolet rays to light rays, whereas the diffusion leaves the wave length unchanged so that dark rays remain dark rays.

When now we examine this fluorescent light with a Nicol prism to see whether it is natural light or polarized, we find that the light is wholly natural. Thus we have proved that the fluorescent light of the lens is natural light.

Diffused light is much more complicated. According to G. Mie[30] the composition of diffused light varies in connection with the size of the particles which cause the diffusing. The Figures 6, 7, and 8 derived from Mie show the composition of the light dispersed by gold balls of infinitely small dimensions, from 160 to 180$\mu\mu$ diameter.

In the figures the incident light is natural light, the intensity of the radiations is drawn in proportion to the length of the sectors coming from the dispersing ball. The outer curves cut off from the sectors parts, which are proportional to the total radiation; the inner curves show in the same way the unpolarized radiation; the intermediate part of the sectors is proportional to the polarized radiation. The arrow indicates the direction of the incident light rays. When infinitely small particles are the cause of the dispersion we see in Fig. 6, that in a direction perpendicular to the incident light the diffused light is totally polarized. A Nicol prism can, when applied perpendicularly to the directions of the incident rays, extinguish the whole luminescence. By turning the Nicol perpendicular to this absolutely dark position, we see the Tyndall phenomenon in its

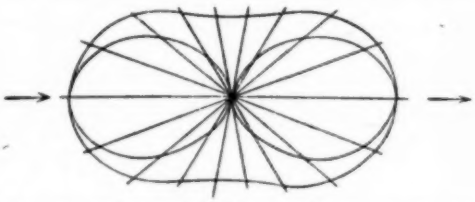

Fig. 6. Diagram explaining radiation by an infinitely small gold ball.

full strength; in every other position we find mixed light partly polarized, partly natural, except in the direction of the incident rays, where the whole light is natural as Fig. 6 plainly shows.

If bigger particles cause the luminescence, Fig. 7 and 8 show us, that in neither direction is the dis-

persed light totally polarized; therefore the Nicol will nowhere find a position in which it can totally extinguish the Tyndall phenomenon. The maximum of polarized light is to be found at an angle of 120° with the incident rays.

We now know that we can determine whether a luminescence is caused by fluorescence or by diffusion by examining the light phenomenon with a Nicol prism perpendicular to the incident rays.

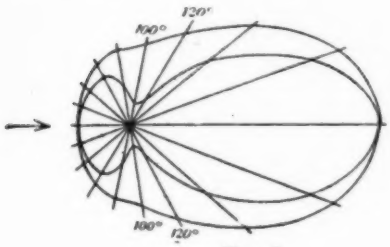

Fig. 7.

Fig. 7. Diagram showing radiation from a gold ball 160 μμ in diameter.

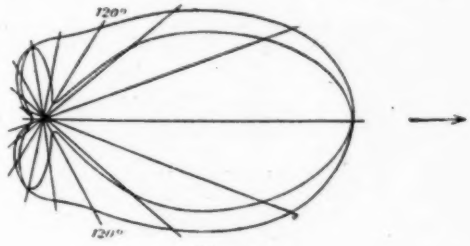

Fig. 8.

Fig. 8. Diagram showing radiation from a gold ball 180 μμ in diameter.

From this examination we have three possibilities:

1. The whole luminescence is fluorescence; then the light is wholly natural; in every direction of the Nicol the luminescence remains the same.

2. The luminescence is diffused light only; we now find, if it is caused by infinitely small particles a position of the Nicol prism in which the whole luminescence is extinguished, and by turning the Nicol the Tyndall phenomenon reappears; if bigger particles are present, we cannot find an absolutely dark position but the minimum and maximum of luminescence will show a considerable difference.

3. Fluorescence and diffusion are both present; we now find in a certain position of the Nicol prism a maximum of light, composed of fluorescence and diffused light; perpendicular to this position a minimum is found, which is fluorescence alone if small particles caused the diffusion or fluorescence, with a certain amount of diffused light when bigger particles did this.

In the lens the third case is present and we can compare the quantity of light in minimum and maximum positions by photometric examination; and in this way get an idea of the proportion of fluorescence—and diffused light. If, for instance, the minimum light were a quantity (a); the maximum (b); then a, the diffused b-a, if small particles caused the diffusion. If bigger particles did this the fluorescence would be less than a; the diffused light more than b-a.

In this manner I was able to prove in 1911, in the physiologic laboratory of Professor Zwaardemaker in Utrecht that the lens of rabbits, guinea pigs, frogs, pigs, cows and calves show diffusion, are optically heterogeneous. The experiments were made in the following way: The light of a projection arc lamp was concentrated by quartz lenses and diaphragms, the animal lens was placed in the light bundle and the resultant luminescence was examined with a revolving Nicol prism placed perpendicular to the direction of the incident light bundle. With photometrically examined "London smoke" glasses, placed between Nicol and animal lens, tests were made, as to which density of "London smoke" glass was necessary to extinguish the luminescence totally, at maximum and at minimum luminescence. The proportion of the density of these "London smoke" glasses gave the proportion of the intensity of the maximum and minimum luminescence.

In the course of this research the diffused light proved to be always stronger than the fluorescence. When quartroptic was used, so that the fluorescence appeared as strong as possi-

ble the polarized light was still about two times stronger than the natural light. If optical glass was used, or even a solution of picric acid or Hallauer glass was placed between arc light and animal lens, so that the fluorescence was diminished greatly, the proportion of polarized light was much greater in many experiments. In a great number of lenses the proportion 31-1 was found.

As we saw above the natural light is either only fluorescence or even fluorescent light with somewhat diffused light, so we may conclude from the experiments that the diffused light is 2 to 31 times stronger than the fluorescent light. In this way the optic heterogenity of the lens was sufficiently proved.

Another proof is that, if we exclude from the primary light bundle these rays which cause the fluorescence, the luminescence remains; this remaining luminescence is then diffused light only.

In this manner I proved in 1911 the internal diffusion of light in the lens, by excluding fluorescent rays with Hallauer glass, or picric acid solution; Schanz in 1913 by excluding those rays with euphos glass. Even if I interposed Hallauer glass No. 66 and No. 64 together both 2 mm. thick, glasses which absorb a considerable amount of light rays, the Tyndall phenomenon was still so strong that it could be easily photographed.

To this proof the objection may be raised that we can not know exactly if all the fluorescence is excluded so that the remaining luminescence can still be partly fluorescent light. Much more convincing is the proof if we examine the Tyndall phenomenon in pure spectral light. Dr. Zernicke, lecturer in physics at this university was so kind as to make these experiments with me.

The spectrum of a mercury vapor lamp, was divided into a range of rays, by a train of lenses and prisms made of quartz, and a part of an animal lens was held in the different rays. The luminescence which immediately appeared was of different kinds in the various parts of the spectrum. In the ultraviolet rays, it was pure fluorescent light, and therefore natural light only; in violet and blue it was partly natural partly polarized; in yellow and red it was totally polarized. We were able to find a position of the revolving Nicol prism perpendicular to the incident rays in which the luminescence was absolutely extinguished. This last fact proves not only the presence of the heterogeneity of the lens, but also that the cause of this diffusion is small particles, because otherwise the extinction would not have been absolute in any direction. (Figs. 7 and 8).

The best proof of the heterogeneity of a substance is the direct observation of the small particles themselves. We know that with the method of examination which is called the dark field illumination we can see submicrons of 200 to $6\mu\mu$ diameter which cannot be seen with our ordinary microscopic examination. If we examine animal lenses in this way we see immediately the well known glittering points many of which move rapidly (Brown's molecular movements).

Against all the proofs here described one objection may be raised, that all are executed on dead lenses; so that it is not impossible that post-mortem changes are the cause of the optical heterogeneity, as for instance is the case in chromocytes 1. To prevent this I used material as fresh as possible, absolutely fresh lenses of frogs, guinea pigs, rabbits, etc., and of a child whose normal eye had to be enucleated for a sarcoma. In every case I was able to prove by the dark field, as well as with the Tyndall phenomenon, the optical heterogeneity.

Moreover, I examined the lens in living people and animals. If we throw concentrated light into a human eye with dilated pupil at an angle of 45° with the fixation line we see immediately the luminescence in cornea and lens not in the anterior chamber.

With a Nicol prism perpendicular to the incident rays, and consequently also at an angle of 45° with the

fixation line, we can examine whether the luminescence is natural light or partly polarized. With the photometrically tested "London smoke" glasses we can again fix the properties of natural and polarized light.

It is not necessary for this examination to use intensive lights such as arc lamps, our common ophthalmoscope lamps alone are quite sufficient; for instance a lamp of 16 candle-power with a frosted glass by concentration of the light with a lens of 20 D. gives a very distinct luminescence of the animal lens.

From this examination in living people we get the same result the diffused light in the lens is much stronger than the fluorescent light. We must, however, remember about the fact that a mistake may be made in this way because it is very difficult to avoid reflection of the light and reflected light is often polarized so that the amount of polarized light is not all diffused light and hence the proportions found with "London smoke" glasses do not give the difference between the two kinds of light exactly; therefore we cannot use the figures found in this way. The difference, however, is so great that we can declare absolutely that the lens in the living eye of man and animals is optically heterogeneous.

The luminescence which we observe in every human and animal lens, which is traversed by light rays, is not only fluorescent light but partly diffused light, because:

1. In the dark field we see dispersing particles.

2. The luminescence is for the most part polarized light.

3. The luminescence remains if we exclude the rays which cause fluorescence.

Thus we have proved that:

The animal and human lens is not optically pure but is optically heterogeneous.

VALUE OF DIFFUSION.

If we are thoroughly convinced of this fact, we ask what is the reason of the presence of such an illogical appearance as optical heterogeneity of the eye lens? A fact which robs not only the image on the retina of a part of its light but which spreads also diffuse light all over the retina. The answer to this question is that the heterogeneity of the lens like the fluorescence can be a protection of the retina against ultraviolet rays. How is this possible?

If all kinds of rays of the spectrum were diffused in the same measure, then exclusion of all ultraviolet rays from the retina by diffusion would imply exclusion of all light rays from the retina too, so that no light would be observed. The diffusion is, however, not equal for all rays; but is, if caused by small particles, according to the law of Rayleigh, proportional in inverse ratio to the fourth power of the wave length. If the wave length of just visible violet is 400$\mu\mu$, of just visible red 800$\mu\mu$ then the diffusion of this violet is 800/400 to the fourth power =16 times stronger than that of the red; and if we could radiate the lens with ultraviolet of 200$\mu\mu$ wave length, the diffusion would be $(800/200)^4=256$ times stronger than the diffusion of this red light.

For the ultraviolet rays from 300-400$\mu\mu$ wave length which pass the cornea, the diffusion is about 3 to 1 times stronger than the diffusion of the just visible red and so we have in this diffusion an excellent method to keep many ultraviolet rays away from the retina and to let the light rays pass.

We are acquainted with this peculiar way of diffusion very well in nature; the same sun which at noontime sends his rays perpendicular to the earth sends yellowish white light because the rays traverse the atmosphere only over a relatively short distance. But in the evening when the sun sets, the rays have to cut the atmosphere over a much greater distance. In this atmosphere diffusion takes place to such a measure that many of the violet and blue rays are scattered; and only the rays of greater wave length remain nearly undisturbed so that it is chiefly the red rays that reach us and we see

the sun as a red ball. The dispersed violet and blue rays are the cause of the blue color of the sky which without this diffusion would be absolutely black.

In the eyes we often see the same phenomenon. If great opacities of the vitreous are present which diffuse the light, the disc may seem hyperemic tho in point of fact it is quite normal. The lens disperses the rays in the same way, with the consequence that the visible rays pass nearly undisturbed whereas the ultraviolet rays are scattered on all sides. In this way we can state the optical heterogeneity of the lens to be a protection of the retina against undue influence from rays of shorter wave length. In returning to the open question why the ciliary processes can be damaged by light rich in ultraviolet rays, we can now by means of the optical heterogeneity of the lens give an answer.

In the lens the greatest diffusion of light will take place in the anterior part because many of the ultraviolet rays will not even reach the posterior part. If we regard the position of the lens in the eye and ask whither the diffusely dispersed rays will go, then we see that a great part will reenter the anterior chamber by the pupil, another part will irradiate the posterior layer of the iris, a third part will go sideways to the processes ciliares, a small part to the anterior portions of the retina and choroid, or even spread diffusely over the whole retina.

CILIARY BODY AND CATARACT.

The third part strikes the ciliary processes at their most vulnerable point, the fully unprotected epithelium. We saw in Fig. 5c, that, if the lens is traversed by light in its sagittal axis a considerable amount of light is diffused sideways, that is, in the direction of the ciliary processes. Now we must bear in mind that a much greater part of dark ultraviolet rays, is thrown in the same direction; so that by the optical heterogeneity of the lens the ciliary processes are illuminated by light very rich in ultraviolet rays. This fact can have as a consequence that if intense light strikes the eye as was the case in the experiment of Birch-Hirschfeld, the ciliary processes may be seriously damaged; as Birch-Hirschfeld observed desquamation and swelling of the epithelial cells, hyperemia, hemorrhages, fibrinous exudation in anterior and posterior chamber. The posterior layer of the iris is struck by more rays than the ciliary processes, but it is far less vulnerable. Notwithstanding, Birch-Hirschfeld observed distinct damage of this layer and even the anterior part of the choroid was very hyperemic.

Thus optical heterogenity can explain how the ciliary body, tho well hidden, becomes inflamed; and how the pain may arise in snow-blindness and ophthalmia electrica, on touching the ciliary regions; and perhaps it is also responsible for the ciliary neuralgia which bothers the patients so much.

If the ultraviolet rays are less in number and the light which strikes our eye is not so intense, as, for instance, daylight and the artificial light we use, no inflammation will occur; but the continual everlasting radiation of the few ultraviolet rays on the ciliary processes, will be able in the lapse of years to cause small changes in the epithelial cells, so that the secretion is changed a little. Even a very trifling alteration of the aqueous is sufficient to cause malnutrition of the lens; which may, in the course of fifty years and more, lead to obscuration of the lens, to senile cataract.

The above mentioned experiments of Parsons, Henderson and Martin proved that the secretion of aqueous by the ciliary epithelium can be interfered with by radiation with light rich in ultraviolet rays. Peters[31] established the theory that many cataracts find their origin in small changes of the ciliary epithelium, so that the secretions and consequently the osmotic pressure of the aqueous is altered. In many cases he could find by microscopic examination lesions of the ciliary epithelium. I believe, that changes of the ciliary epithelium, requisite to alter the secretion of aqueous so that senile cataract ensues, may be so small that it is not possible to find them in every case of senile cataract, even by careful microscopic examination. It is possible that

the changes are so small that they escape our examination but are sufficient to change the aqueous humor and the nutrition of the lens.

In this way we can explain the acute inflammation of the apparently well protected ciliary processes by irradiation of light rich in ultraviolet rays, the senile cataract, the observations of Hirschberg, Grosz, Schwitzer, Schulek, Daland, Walter, Ascher, etc., that senile cataract is more frequent and comes earlier in regions and countries which are more exposed to light rich in ultraviolet rays, and in people who expose themselves more than others to such light. Until now every theory that attempted to explain the connection between radiation and senile cataract went astray, because the rays work on the pupillary part of the lens (where they can cause opacities and epithelial changes), whereas senile cataract begins as a rule in the periphery.

Schanz, who established the theory that the ultraviolet rays change the soluble albumins of the lens into less soluble ones, and cause in this way opacities, uses the internal diffusion to explain how the whole lens can become obscured. But even when this is granted it is not yet explained why the senile cataract does not begin in the pupillary part of the lens, which in this theory must also be the case. In my theory the cataract may begin anywhere in the lens where the malnutrition of the lens has the greatest influence or where a locus minoris resistentiae is present.

If the lens diffuses light it is not the ciliary processes which get the most of the ultraviolet rays; the inner layer of the iris will get more and the pupillary part of the iris will get most; this is directly struck by the incident rays, and from behind by the rays reflected by the lens, and by those which the lens diffuses; whereas the posterior layer of the iris only gets diffused rays.

When the diffusion of the lens is so strong that cataract ensues, it is probable that the pupillary part of the iris, and perhaps even the posterior layer of the iris will suffer too, from the radiation of rays of short wave length, tho they are much more resistant than the ciliary epithelium.

Have we any evidence in literature about the alteration of the iris in cataractous eyes? Yes, Lindberg[32] found that in eyes with senile cataract, at the pupillary border depigmentations and gaps were very often to be found. This is not a casual coincidence, nor are they both senile symptoms, for those same alterations at the pupillary border cannot be found in old people without cataract.

Hence there is according to Lindberg a connection between senile cataract and pupillary alterations. He was unable to examine sufficient patients giving useful results with diascleral transillumination, to decide whether there is also such a connection between affection of the posterior layer of the iris and senile cataract; but most of the cases which he examined showed such a connection plainly. We see that the observations of Lindberg give just what we should expect if the theory above established is right.

SENILE DEGENERATION OF THE MACULA.

If the diffusion of light in the lens is really a protection for the retina against ultraviolet rays then the lens which protects the retina best will get cataract. The lens which does not diffuse light will not protect the retina, but will remain healthy itself because the ciliary processes do not become afflicted.

As we know from the observations of Hallauer, Schanz, Birch-Hirschfeld and others, the transmission of ultraviolet rays thru the lens is individually very different; so that some lenses let the greater part of ultraviolet rays which crossed the cornea pass to the retina. Hence we ask, is any affection of the retina known which can be due to the ultraviolet rays, and can be compared to the senile cataract? I think we have such an affection in the senile degeneration of the macula lutea, an affection which appears as a rule after sixty years and becomes more frequent the older people are.

It is no wonder that the macula should be affected most because when light falls into the eye the macula is usually one of the most illumined parts. The macula as the highest organized part, is also the most vulnerable, and moreover, it is the least protected part.

According to Birch-Hirschfeld the inner layers of the retina diffuse the ultraviolet rays and can be damaged by them. They protect the outer layers. In the macula the inner layers are few and thin, so that the cones and rods are nearly unprotected by them, and can be damaged by the ultraviolet rays.

We saw that in undue reception of light rich in ultraviolet rays the macula was often afflicted, (Central scotomata, white and whitish spots in the macular region, by artificial light sources as well as by natural light).

If the supposition that senile macular degeneration is a consequence of ultraviolet rays is right; the degeneration ought to be found in old people without cataract. For, as we saw, the lenses which get cataract in consequence of their diffusion of rays protect the retina, whereas the lenses which let the rays pass so that the retina gets affected remain clear. Consequently there must be an opposition between senile cataract and senile macular degeneration. If one of them is present the other must be absent or very much less developed whereas if both were pure senile symptoms they must appear nearly always in the same eye. How is this in human eyes?

In my Groningen clinic I had a good opportunity of studying these proportions thoroly, because senile macular degeneration is with us a very common affection. In the four years from 1916 to 1920 I found among 16,602 eye patients in my ambulatory, 1,336 of an age beyond sixty years. 1.788 of them suffered from macular degeneration. The affection was found in patients from 61 to 70 years in 6.125%, in patients from 71 to 80 years in 23.06%, and in patients beyond 80 years even in 30%.

The visual acuity was always greatly diminished tho the ophthalmoscopic changes were usually small. As to cataract I have never found a degeneration of the macula directly after the extraction of senile cataract, and in the records of about 500 cataracts operated on in the last 20 years in this clinic, I have not found one case either.

In textbooks of ophthalmology the presence of a macular degeneration after cataract extraction is always described as a very disagreeable but rare occurrence. If both were real senile symptoms, this occurrence would be, on the contrary, very frequent.

Among my patients with macular degeneration we have by very careful examination found, with pupil dilated to the utmost, lens opacities in 44% in patients of more than sixty years of age, in 47.3% in patients of more than sixty-nine years of age. Whereas we found lens opacities in 90% in patients of more than ninety years of age, without macular degeneration, in more than 80% of those older than sixty-nine years, just like Barth and Vogt, and according to Hirschberg and Hess. The latter writes that by careful examination of the lenses of people older than sixty years the absence of any opacity is even rather rare.

Thus we see that in our patients cataract appears only in half the number of the cases if macular degeneration is present, that it does if there is no macular degeneration. If we consider, moreover, the fact that the opacities in patients with macular degeneration were always very few and small, whereas in other patients the opacities varied from very small to mature cataract, we come to the conclusion that a very pronounced opposition between senile cataract and senile macular degeneration is observable.

I may add to this that the research on the macular degeneration and cataract frequency, was done quite apart from the theory above mentioned. The contrast of the two eye conditions was found out in the clinic, before the theory was developed as far as this. So that the eye surgeons who made this research were not under suggestion of what had to be found out; afterwards the result of the research was put in connection with the theory. We see that this result also is what we should have to expect if the theory of the influence of the light diffusion by the lens is right.

According to the more or less strong heterogeneity of the lens and the resistance of ciliary processes and retina to ultraviolet rays we get four possibilities.

1. The lens diffuses the light very much, the retina remains unaffected,

the ciliary processes are struck by the rays, and consequently the lens becomes obscured. This seems with human beings the usual case, as beyond sixty years 90% show opacities.

2. The lens lets all rays pass, remains clear but the retina may get diseased.

3. The lens diffuses so much that it gets obscured but lets so much pass that the retina too gets affected.

4. The ideal lens which seems to be very rare, diffuses so that the lens as well as the retina remain unaffected.

Now-a-days ultraviolet radiation is being used as therapeutic agent for corneal disease in Uhthoff's clinic by Chotzen and Kuznitki[33]. The radiation was always performed at the upper corneal border, not before the pupil. One of the consequences of the radiation was circumscribed depigmentation of the iris at the place where the radiation was performed. The results were good.

The risk of damaging the eye is not great, because the radiation time was very short, i. e., 5 to 15 minutes. In this time a Kromayer's mercury vapor lamp such as was used, will not do much harm to the eye, especially when the precaution is taken not to work in the pupilary part. But I think that even if it was radiated in the center of the cornea not much harm would ensue in so short a time.

PROTECTION FROM LIGHT.

If the proposed theory is right, it is a question whether we ought to protect our eyes from this undue effect of light rich in ultraviolet rays in order to prevent our getting cataract or macular degeneration in old age.

Sometime ago, when the possible effect of ultaviolet rays was very much over-rated it was proposed to make our windows of protecting yellow-green glass, to cover every artificial light with them and to wear goggles. Now-a-days, nobody, I think, will be so afraid of those rays as to condemn people continually to wear protecting goggles; and I think also that it is not at all necessary to protect our eyes continually. We must remember that to cause one of the above mentioned senile affections those continually working under such rays need fifty or more years; so that a little protection will be sufficient to bring about that those affections do not show themselves dangerously in our lifetime.

Normal people, for instance, might wear one of the protecting kinds of goggles, only when they are more than usually exposed to ultraviolet rays, e. g., on sunny days at the shore, or on the river, or on strongly reflecting roads and places on ice and snowfields, in hunting in the fields, etc. People who have to labor continually in the vicinity of lamps which irradiate many ultraviolet rays will do well to cover the light with one of the protecting glasses.

Quite another question is it for people such as astigmics, myopes, etc., who are already obliged to wear spectacles. Though they are already a little protected by the usual glasses, it would be but little disagreeable to them to have their glasses a trifle tinted as Hallauer. This is not ugly; it does not discolor the objects one sees, and as we know from hunters, it makes vision rather better than worse, so that there is no reason to refuse a protection which will be enough to prevent the undue effect of ultraviolet rays.

In all this we must remember that tho we may be convinced that light rich in ultraviolet rays is a principal factor in the origin of cataract and retinal degeneration, it is only one of the numerous factors which may have an influence on the origin of these diseases. That senile cataract proves to be often hereditary (Vogt)[2], does not contradict our theory; because the heterogeneity of the lens, which so differs in individuals may be heredity more in one family than in another.

SUMMARY.

1. The lens is optically heterogeneous.

2. Ultraviolet rays may seriously

damage the retina and the ciliary processes as well by natural light (snow blindness) as in artificial light or in experiments.

3. Senile cataract and senile degeneration of the macula exclude each other in a certain measure; if one of those affections is present the other is absent or less developed.

It is probable that

1. The damage of the ciliary processes by light rich in ultraviolet rays is caused by the optical heterogeneity of the lens; which disperses a part of the rays and especially the ultraviolet to the ciliary processes and in other directions.

2. A principal cause of the origin of senile cataract is the influence of light rich in ultraviolet rays, such as daylight; which causes the opacity by interfering with the nutrition of the lens, in damaging the ciliary processes by rays dispersed against their epithelium.

3. One of the principal causes for the appearance of senile macular degeneration is the influence of light rich in ultraviolet rays which has passed the lens.

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NASAL INFECTION THE BASIS OF CERTAIN OCULAR LESIONS.

JOHN B. POTTS, M.D.

OMAHA, NEBRASKA.

This paper, opening a discussion upon the subject, emphasizes the need of close cooperation by ophthalmologist and rhinologist to secure a complete clinical picture of the case. It outlines a classification of such cases. Read before the Colorado Congress of Ophthalmology and Oto-Laryngology, August 5, 1919.

In presenting this paper I bring before you a subject which is comparatively new; but which has been investigated with unusual thoroness by quite a number of very able men, largely ophthalmologists.

I have very little to add to what has already been written but the subject is one of such importance that I think it well for us to discuss it in our meetings frequently. There is probably no group of lesions which more intimately concern the ophthalmologists and laryngologists and which are of such serious importance to the patient. This close cooperation and coordination is all the more essential to success, in that the diagnosis often has to be made on very meager findings which might be easily overlooked. Even a condition of such severity as to cause a retrobulbar optic neuritis, when due to an acute streptococcus infection, may show such slight symptoms in the nose as to be extremely difficult to detect. This is all the more true as the roentgengram usually fails to give any indication of infection and leads to a false diagnosis if depended upon.

By this I do not mean to say that I do not believe in the use of the roentgengram, I do use it always; but I have come to know its limitations. It is very valuable to show the size and position of sinuses and of pus in them when it is thick and opaque.

As oto-rhinologist in association with Drs. Gifford and Patton, searching the nose and adjacent structures for the underlying cause of these ocular manifestations, I have come to the conclusion that it is very essential for a rhinologist to have the history, etiology, physical findings and diagnosis from the oculist, as many conditions in the nose which could be passed as normal under ordinary circumstances become pathologic when associated with certain manifestations.

As an illustration, suppose Dr. A., oculist, refers to Dr. B., the rhinologist, a patient with a note stating, Mr. C. partial blindness of right eye or O, second, Mr. C. vision of right eye failing for past three days; pain over right temple. Vision right eye 20/100, left eye 20/20; blind spot enlarged; concentric contraction of field for form and color, as shown by diagram; ophthalmoscopic findings, normal. Diagnosis, probably retrobulbar optic neuritis. By comparison of the former statement, it is easy to see that while the first may be almost any disease to which the eye is subject, and hence leaves a very wide scope for investigation, the latter confines the disease to a definite portion of the optic nerve, and at the same time brings the search for its cause within quite restricted limits. With the above findings any deviation from the normal of the posterior ethmoid, sphenoid, or contiguous structure is most important, even tho they be so slight as to be ordinarily of not much significance.

The great importance of such a report with the case is that it gives to the rhinologist a basis to apply the facts brought out by the different workers in this field. Onodi in demonstrating the relationship of the optic nerve to the sphenoid and posterior ethmoid cells; Posey, Brawley, Loeb, Bryan, and others for the role played by the accessory sinuses. Parker, Patton, Louis Zeigler, and their studies demonstrating the relationship of blepharospasm, photophobia, blepharitis, epiphora, superficial corneal ulcers and reflex ocular disturbances, to a pinched middle turbinate or impinging spur, and Risley, Reber, Knapp, deSchweinitz, MacWhinnie, Parker, and others,

on the perimetric findings associated with diseases of the sinuses.

CLASSIFICATION.

It is unnecessary for me to go into detail before this society in regard to this most interesting work even tho I had the time. For my own convenience I have classified these ocular disturbances as follows:

1. Metastatic infections.
2. By continuity.
3. Trophic and irritative.

1. The metastatic infections are carried by the blood or lymph stream, and belong to the same general class as the acute infectious arthrides and myositides. In children and young people they are most frequently due to the tonsils. As the sinuses develop they play an increasingly important role; and with the decay of the teeth aveolar abscesses are the source of infection. Pyorrhea, unless of extreme degree, is in my opinion, seldom the cause of metastatic infection. In this group is iritis, episcleritis, uveitis, chorioretinitis, retinitis, neuritis and orbital cellulitis.

2. By direct continuity. Owing to the intimate association of the optic nerve with the sphenoid and post ethmoid cells, any inflammation of the latter is liable to involve it. The same is true in orbital cellulitis from the ethmoid, antra, or frontal sinuses.

3. Trophic or irritative. This is a very interesting group of diseases and belongs to an entirely different class from those in the former two. Here we have a lesion produced in a neighboring organ, by an irritation of branches of a common nerve, or thru the sympathetic nervous system. Many of the lesions in the eye such as a superficial corneal ulceration seem to be of a herpetic nature. The condition in the nose is not necessarily an inflammatory one. In this group is blepharitis, photophobia, blepharospasm, epiphora, superficial minute corneal ulcers, and ocular pain.

This classification while it may not hold true in all cases, has the advantage of giving the rhinologist a definite working basis. Metastatic infection necessitates a focus of infection, usually with the formation of pus. Infections by continuity frequently present greater difficulties; as the infection may not result in the formation of pus, but may be confined to an inflammation of the mucous membrane lining the cells, and extending directly to contiguous structures. I have found it not infrequent in a retrobulbar optic neuritis, that upon opening a sphenoid or posterior ethmoid cell, there was a marked inflammation of the mucous membrane but no pus. The proof of the diagnosis, however, has been established by the prompt improvement of the vision.

It is this class of cases that are most baffling, and to make a diagnosis requires the closest cooperation of the ophthalmologist and rhinologist. The history usually reveals that from one to twelve weeks previous to the onset of the eye symptoms the patient had an acute cold or other malady involving the nose, from which in many cases they seem to have entirely recovered. Only one eye is affected, or if both, the onset in one preceded the other. Usually there is a history of acute pain over the midparietal region, often confined to an area not larger than a quarter of a dollar, and distinctly tender. There is usually pain referred to the temple of the affected side. If the vision is sufficient to get a field, the enlargement of the blind spot and concentric limitation for form and color, can usually be demonstrated.

Ophthalmologic findings are generally negative. If there is the usual evidence of an infected sinus, e. g. tumefaction of the turbinates, some hyperemia, and pus from the ethmoids and sphenoid, a diagnosis is easy. But in many of these cases, especially if of streptococcic origin, when seen early the deviation from the normal is slight. Careful examination, however, will usually reveal one or more of the following: A slight edema or turgesence of the mucous membrane of the middle turbinate or ethmoid; a redness of the mucous membrane of the nasopharynx often unilateral; a swelling of

the posterior tip of the middle turbinate, or a slight discharge on the posterior wall of the nasopharynx from the ostium of the sphenoidal sinus. In many cases it is possible to probe the sphenoidal sinus with a slightly curved canula, and if pus is present, it can be demonstrated either by irrigation or suction.

In those cases in which the lesion is due to trophic disturbances or irritation, the determination of the cause is frequently difficult. If there is a spur pressing upon one of the turbinates, or a marked deviation of the nasal septum, they may well be chosen. Any evidence of infection of the ethmoid indicates it as the point to be attacked. A hypertrophied middle turbinate may harbor an infected misplaced ethmoid cell; or in the absence of any of these, an apparently innocent middle turbinate may be tumifying at night or at other times when the patient is not under observation sufficiently to furnish the required irritation.

The treatment of all these cases is to remove the offending cause. If this can be done promptly without endangering the eye by treatment, it should be employed; but if the optical lesion is serious, there should be no hesitation in instituting whatever surgical procedure is necessary.

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PRACTICAL OBSERVATIONS ON REFRACTION.

I. W. Haughey, M.D.,

AURORA, NEBRASKA.

With an account of the routine methods employed in refraction work, the author gives his estimate of their relative importance, and observations concerning certain unsettled questions. Read before the Colorado Congress of Ophthalmology and Oto-Laryngology, August 4, 1919.

Under the recently inaugurated movement to improve instruction in ophthalmology in medical and post-graduate schools, a need proven by the experiences of the war, there will be required first of all improved methods of instruction in refraction. This is the greater part of the specialty, highly technical, and in this most of the errors are made. A plea for greater accuracy in refraction, and study devoted to the individual case is the basis for a paper on this time worn subject.

That glaring blunders are committed by men in the specialty, to say nothing of the so-called optometrists, needs no proof; the number of small and avoidable errors in the practice of almost every refractionist is greater than he might be willing to admit. Recently a patient came to me wearing a pair of

prisms of 5 and 6 degrees bases out, and this same patient was immediately able to fix distant objects with some difficulty, correcting 5 degrees of hyperphoria at the same time, after the glasses had been removed. The patient was first supplied with a pair of weaker prisms bases out, and in a short time had been given these strong prisms. Such a prescription can have no justification whatever. The hyperphoria should have been partially corrected; and if the esophoria would not yield to prism exercises, an operation should have been done.

The ideal in refraction is to make the eye emmetropic. Emmetropia is described as that condition of the eye which will permit of perfect distant vision with the eye absolutely at rest; a condition rare indeed. By far the larger number are hyperopic to a small degree, and the question arises whether slight hyperopia is not the normal condition. Certainly it is if an average is to be considered normal. Personally I believe such to be the case, since such an eye can see perfectly at distance without apparent effort, and no trouble results until the presbyopic age is reached. Unfortunately for this belief there are a great many more with astigmia, and no one will contend that astigmia is a normal condition.

Methods. First, a carefully made manifest test with the trial case, dial and test letters. This test is identical with that used after the cycloplegia, so it will be described here. One eye is tested at a time. Strong lenses are used at first, and weaker ones gradually substituted until one or more of the lines of the dial are distinct. The axis is fixed by the relative distinctness of the lines on either side, and the fogged lines cleared up with minus cylinders at 90 degrees to the major axis; being very careful not to over correct, which is a much more serious error than under correction. A weak sphere is then held in front of the combination and the patient asked whether the lines are equally fogged. If so a weak minus sphere is tried to note if vision is greatly improved. When the best possible appearance of the dial is obtained, the vision on the letter chart will usually be 6/6 or better. After both eyes are tested the opaque disc is passed before each alternately, and any difference in vision corrected by slight change of spheres. The muscular balance is then determined by means of the Maddox rod and phorometer, in vertical and horizontal meridians; the adduction and abduction by means of rotary prisms, and the abduction in accommodation, and movements by the finger or pencil.

Cycloplegia is usually rapid and thoro from instillations of 1 per cent solution of homatropin every 10 minutes for one hour, seven instillations in all. It will not be complete at the end of the hour, but in 15 to 30 minutes later.

Retinoscopy under these conditions yields very accurate results, and seldom will the chart test fail to show approximately the same. Since the arm is a better measure of distance than the eye the half meter distance is more accurate. A little practice with the tape measure will show the proper curve of the elbow to obtain the half meter, but should be used occasionally to "check up" distance. This is also more rapid because the lenses are quickly changed and the frame can be dispensed with. Cylinders can be used in combination with the spheres if desired, holding the lenses together. In my own experience the greatest difficulty has been from insufficient cyclopegia, which must be complete to obtain reliable results. When used in the manner described little difficulty has resulted. Two or three instillations will not suffice, but must be continued for an hour and the retinoscopy done 15 to 30 minutes later.

The chart test made in the manner described, without regard to the retinoscopic findings will usually give the same results, but where there is a slight difference the chart results should be used if the patient is intelligent, and responsive. The final prescription should usually total about the same as the total manifest error, since

a much greater sphere will cause the patient to reject the lenses. If, however, the latent hyperopia is great, a portion at least should be corrected. I do not believe it necessary to correct the latent hyperopia of the young unless it is excessive, or correction called for by reason of squint or heterophoria. Uusually a reduction of one-half to one diopter will make the lens about the same as the total manifest error. Where it is desirable to correct a large latent hyperopia a postcycloplegic test should be made, not less than 4 days later. This is an excellent procedure in all cases where possible.

The haphazard method of holding a sphere before the eye and asking the patient "is that better," and using the cylinders in the same way, is not a scientific method by any means, and seldom will an accurate measure of the astigmia result. There have been many objections made to the use of *the dial,* and some have gone so far as to dispense with it entirely. I do not see how it is possible to measure astigmatism without it, or some of its various modifications, all of which embody the same underlying principle. Perhaps it can be done. It should be interesting to learn how.

The lens desired is that with which all of the lines of the dial will be fogged by the addition of a weak plus sphere. That is the lens which makes the eye emmetropic, and which should be prescribed, less the amount of latent hyperopia it is not desired to correct.

Hyperphoria should be corrected to one-half or one-third of the total by prisms, bases at 90 degrees, up and down. No prisms should be used for lateral deviations.

A careful *study of the fundus* should be made in every case, using an ophthalmoscope that will permit of rapid changing of the lenses without altering the position of patient, observer, or instrument. No single lens will give a clear view of all details of the fundus, the presence or depth of the physiologic cup, or presence of opacities of the media. Hence the necessity of an instrument which will enable the examination to be made without loss of time or annoyance to the patient. A large number of interesting anomalies of the fundus, as well as pathologic conditions, are discovered by its routine use.

PRESCRIBING LENSES.

In prescribing *bifocal lenses* the strongest possible distance lens should be used, and the weakest reading segment that will suffice, taking into consideration the character of the work to be done. Desk work will require clear vision at 20 to 30 inches, and an ordinary reading segment will be too strong for the purpose. If the distance lens is right it will seldom be necessary to prescribe more than 2.50 D. or at most 2.75 D. even in extreme old age.

The fitting of frames is a sadly neglected subject in literature and practice, but a no less important one than refraction. What benefit will result from the most careful refraction, if the lenses are improperly held before the eye, pupillary distance too great, too close or too far from the eye, or one lens higher than the other? They should be as close as the lashes will allow; as large as the P. D. will permit, or if larger then the lenses should each be decentered inward to one-half the difference. Observation has shown that this important work is often left for others to do, perhaps unskilled, and the ophthalmologist never sees the patient after the frames are fitted. The result has sometimes been that the patient is thoroly dissatisfied with an excellent refraction, unaware that the frames are at fault and blames the ophthalmologist for the failure.

From my own observation and conversation with others I believe the use of tinted lenses mischievous in the extreme. To accustom the eye to a modified light is to make it more sensitive to the rays filtered out by the lens. The patient is then in the same condition as before the tinted lenses were used, unable to get along without them, still suffering from the light received thru them. This is exactly analogous

to the use of prisms for esophoria and the results are about as bad. A better way would be to prescribe clear lenses for regular use, and a pair of pale amber tint for use in exceedingly bright light, and under that condition only. Most of the complaints of photophobia will clear up under the use of properly fitted lenses, and the tinted lenses will not be needed. When tints are prescribed they should be of a pale amber color. Amethyst glass filters out only the longer rays and admits the violets, thus defeating the purpose for which they were intended, and should never be used.

The retinoscope offers a field for a greater divergence of opinion, than any other part of this work. A personal application to an acknowledged leader in the specialty was answered by the statement that he did not consider it reliable in any case, useless in most cases, and that he did not use it where any other method was practicable. He also stated that he knew of no ophthalmologist who used or recommended it. This answer in the light of the present indicates that he could not have been familiar with its use. The School of Ophthalmology at Camp Greenleaf designed by Col. de Schweinitz, and conducted by Major Meyer Weiner was one of the best postgraduate schools for the reason that it was properly systematized, a quality sadly lacking in the average postgraduate school. At this school great emphasis was laid upon retinoscopy; and undoubtedly many of the students who were unable to use it successfully before that training are now making practical use of it.

If in the hurry incident to a large practice not more than 5 to 15 minutes are devoted to a single case an injustice is done to both refractionist and patient. It is hardly possible to do an accurate refraction in so short a time, and if the method described is used it will require at least 30 to 45 minutes. The custom in some places of each of a number spending a few minutes with the patient, comparing results and prescribing a composite lens is not good practice. Patients complain bitterly of this procedure, and since a part, at least, of the work is done under incomplete cyclopegia, the results are necessarily in doubt. A careful measure by one refractionist giving sufficient time to insure accuracy would save as much time as the partial work of a number and be much more satisfactory to him and the patient.

In a recent number of the American Journal of Ophthalmology is a statement from an eminent writer that in every case except young children a myotic should be used to overcome the effects of the homatropin. At least this is debatable ground. A personal use of it, with proper consideration of the discomforts during the hour following will be a strong argument against its use. In a proper subject for homatropin no unfavorable symptoms will ever result; the patient will be quite comfortable with a pair of amber sun glasses, and able to use the eyes to a limited extent the following day.

HETROPHORIA AND HETEROTROPIA.

WILL WALTER,

CHICAGO (EVANSTON), ILL.

This discussion of its subject from an unusual point of view, connects the ocular movements with the autonomic or vegetative nervous system, and urges the importance of early correction of ametropia, before the Michigan State Medical Society, May, 1919.

I do not know that I bring you any special message on ocular balance—rather imbalance—in response to the kind invitation of your program committee. The subject is a complicated one, and many viewpoints are necessary. Often men in discussion, are expressing the same views in varying terms.

Some different—perhaps original—conceptions of basic principles have been evolved which may be of interest to view. Our discussion will therefore be very general and is based upon what may be called a psycho-physiologic viewpoint.

NORMAL BALANCE of the globes under control of the extraocular muscles is desirable for several reasons.

First: For binocular single vision—when possible. This presupposes the functioning of both eyes for better seeing and is present only when sufficient vision exists in a fellow eye to help by fusion of its image with the fixing eye. If the visual axes are parallel, binocular vision is better than monocular even though one eye carries a much lower acuity. In this case the poor seeing—or as we shall call it, the trailing eye—gives steadiness by peripheral stimuli when central vision is low, and probably always by motor impulses, the quickened mental aptitude which goes with the use of two symmetric anatomic body elements over one alone. This is easy of verification in daily tests.

We have come to believe that even with equal and normal vision in both eyes, one eye is fixing whilst the other is steadying and aiding by adjuvant impulses of retinal and motor stimuli. In right handed subjects it is usually the right eye which fixes and the left which trails, whilst in the left handed the left eye leads and the right does the reenforcing. Assuming equal vision in both eyes, there are few exceptions to this. You are of course familiar with the hole in the card test but I would be pleased to have you test it in your own cases as a matter of interest, if you have not tried it, and find whether you are right eyed if right handed, or left eyed if left handed.

A study of ocular rotations in normals gives evidence that this is of some importance. It will be found by the tropometer that there is more power of adversion in left eyes of right handed subjects and more in the right eyes of left handed subjects. If right handed subjects are habitually right eyed, fixing as they do with the right eye in the primary position, and looking straight ahead—which they also do—causes the left eye to be adverted to fix upon the same object; and the more so the wider the pupillary distance and the nearer the object is viewed.

Coincident with this, I have observed that there is a tilting outward of the vertical meridian of the trailing eye. This, it seems to me, is the explanation of the frequent finding of a "plus declination" of the left eye which Stevens has thought to be due to the greater development of the left hemisphere in right handed subjects. I have come to regard an outward tilt of the trailing eye, and the greater adversion as a normal finding; and I am influenced in my choice of muscles for operation by this factor. Our habit of gaze is below the horizon and toward the median line, and the summation of this training leads to the tilting. Our rotations as you know approximate 35° upward but 50° downward, 45° to 50° outward but 50° to 55° inward.

The **second reason** for ocular parallelism is comfort. Parallelism may

exist under stress with perfect binocular vision but with discomfort. This may be manifest to consciousness or it may not. When it is not its effects are of the most subtle type. There may be as you know any degree of phoria or tropia in subjects without complaints, but the effects nevertheless lie deeply upon the central nervous system; and are evidenced in more or less remote muscle tensions or relaxations and attitudes of body and mind. They show in head poses which are marked in the hyperphorias, or in facial —especially frontal—lines and grimace most noted in hlper-eso- or hyper-exophorias; or in the deep vertical forehead lines and in the stooping posture and half bent knee of esophoria and in the esotropia subject, when vision is fairly equal in both eyes.

In a paper before the Ophth. Section of the A. M. A. in 1916 I linked up the ocular movements with the autonomic or so-called vegetative nervous system. To this we shall refer later. What I wish to call your attention to now is that this system is automatic, is independent of our wills, and is in general acted upon in all of its ramifitions by similar stimuli. This nervous system, as you know, presides over all of our fundamental functions, circulation, respiration, the cardiac rhythm, gastro-enteric peristalsis, the ductless glands; and extends in general where control by volition would be hazardous, slow and impossible.

There is either normal tonus when everything is in balance; or overtonus resulting in excessive contractures, bronchospasm, acceleration of pulse during respiration, and it is everywhere relaxed by atropin; or there is undertonus which is stimulated by pilocarpin or on occasion by adrenalin or by strychnin. We link accommodation and convergence into this system and make overtonus, or over stimulation on one element, lead to overtonus on the other.

A study of this tells us several things but one which seems to have missed attention, viz., that an hyperopia and an associated convergence excess or an esophoria, or an esotropia must, by laws governing the correlation of elements of this nervous system, react upon its other elements. This offers another, perhaps less complicated, explanation of the associated posture, the bent knee, the closed countenance, the enteroptoses so often found in these cases; and per contra, a low accommodation and convergence stimulus with exophoria or exotropia, lead to the reverse of this—the open countenance, the erect posture and all that.

The most uncomfortable subject of all is the myope with esophoria or the hyperope with exophoria, for he is in perpetual neural discord; two sides of the automatic nervous system always in conflict.

The **third reason** for parallelism is for appearance, and this applies to the phorias in minor measure.

Discussion: I would have you think of the influence of the actions and reactions over this fundamental mechanism. It goes on independent of our volition.

We may will to look in any direction or even to converge our eyes, and we know that the frontal lobes have this control over the direction of our gaze. But this volitional control occupies a secondary pathway when an alarming sound, an ominous odor or a surface irritation — an automatically acting stimulus takes the pathway. Otherwise there would be no existence for us, because volition is too slow for defense. This is not speculative, it is demonstrable. For if the frontal lobes are removed or disconnected there is a reversion to the infantile ocular movements—inability to fix the gaze—but there is no lack of parallelism. The binocular functions are disturbed but only temporarily, since definite movements will follow when the gaze falls upon food or when sound or some other stimulus attracts. Movement is then purposeful.

The vegatative system is not infallible and may go wrong, and hence persistent undertonus or overtonus may exist independent of errors of refraction, and such a condition, either as a disorder of automatic

function or as an atavism, would explain exophorias in some cases. This may begin early in life, as convergence insufficiency from lack of tonus, and go over to divergence excess or even to exotropia. This seems a reasonable hypothesis of the etiology of exophoria or exotropia. If this is so, hope is offered through the study of the stimulation of tonus in the automatic nervous mechanism.

APPLICATION: But you ask, has this discussion any bearing upon our real problem—that of correcting these imbalances? It seems to me to have most elemental influence.

Child Study experts tell us that the real formative period is before the fifth year of life. Action stimuli sink deeply into the delicate nervous structures, and the eye covers a large area in this field. Hyperopia and convergence stimulation, or myopia with the lack of it are bad; anisometropia is worse. No one can estimate the evil influence of these elements in the formative period of life.

If this reflex organization is out of tune, the whole structure suffers and we have added reasons for setting them in order as early in life as possible.

I have made the statement that anisometropes should be born "with glasses on" to aid in the early correlation of the eyes. The earliest we can correct is not early enough. If one eye is poor in vision or out of action, it will not fix, suppression of vision will be the way out, and then the effect is divergence or convergence or some combined deviation. This deviation is always in the line of the dominant pull —a physical anatomic effect in these cases—and the long train of contractures or stretchings is in action.

Hysteric effects are never manifest in imbalance—they are always disorders of associated movements. They are in the high level of control, whilst imbalance lies always in the mid or lower levels.

Hyperopia and ciliary overdevelopment, esophoria and esotropia, represent the positive side of this mechanism. They are akin to compensatory cardiac action. The negative side of the mechanism is underdevelopment or dystrophy, exophoria or exotropia, negative or underconvergence or divergence excess. They are akin to loss of cardiac compensation.

One may see the need of correcting errors of refraction before the period of training of coordinations is passed. They are generally well established by the sixth year of life. By this means there is a chance to forestall the overgrowth or undergrowth which, once developed, tends to perpetuate itself under habit impulses. The end-result of relative overstimulation or understimulation over the ciliary arc during the development period will be a phoria so long as fusion can carry the load. It will be a tropia when it cannot. Thus I have made the claim that exophoria and exotropia are due always to lack or relative lack of convergence. Exophoria is negative convergence—actual or relative.

I would call your attention to the fact that there can exist, logically, no power of divergence, nor of sursumvergence. That nothing but diplopia could follow such a primary act. Divergence would have no physiologic value. Therefore when the eye of a subject diverges either under cover or in the open it is due to relaxation on the positive side. It is not a primary divergence act. Certain of the exotropias are atavisms. No development of convergence. No fusion. The arc which influences this segment of the automatic is from the ciliary muscle back to the coordinating centers thence to the convergence. It may overact as in hyperopia or underact as in myopia. It may be relaxed by atropin—or by such a drug as adalin, on the automatic centers, as I have observed. It may be stimuated by pilocarpin types. But the early training of this reflex system is the most fundamental factor in prevention.

How about the practical application of these observations to the case in hand?

As **the first step** we must dismiss from our minds all thought of the primary influence of the will over the

phorias and tropias. This is the first step. Muscle balance is dependent upon the reflex automatic functions first and upon the dominance of pull secondly—the latter depending upon abnormal elements of insertions of tendon and all that.

Our second step is to determine what is a normal balance. I have gone into this esewhere and shall not take your time. My conclusion is that an exophoria of 2° may be fairly considered normal in adults. That under puberty it runs slightly to the esophoria side. The change in normal balance which takes place after puberty is parallel with other changes in the automatic nervous mechanism.

Another interesting thing happens later in life, i. e., toward fifty years of age and beyond; and then we have to look more carefully to the near balance. With the progressive loss of accommodative power comes a disturbance of the correlated convergence and we may find confusion for a time. Perhaps an esophoria, perhaps an exophoria for near. New habits must be formed over this mechanism.

This is a strong point for the early and gradual correction of presbyopia as against the delayed and the big jump method. Early correction furnishes a training of the changed relations. I believe the profession has come to accept an exophoria of 3° or 4° for near as normal. But with advancing years and the application of lenses for presbyopia comes an increasing exophoria for near, due to lack of ciliary arc stimulus. This may attain a pathologic degree; an increase by the Walton test—which is the one I now employ—up to 8° or 10° or even 15° is not unusual. We often have complaints by these patients of discomfort with their near lenses and are apt to find this exophoria for near. Its relief is not easy, since the stronger the near correction the less the stimulus to convergence, and the greater the exophoria, and incidentally the discomfort.

The third step is to realize that imbalance is not due to a muscle but to a coordinated group of muscles. Convergence is a positive function. On the convergence side are three muscles all supplied by the same nerve. Convergence is never due to the action of the internus alone. It is impossible to conceive of any ocular movement being brought about by a single muscle. Maddox has given us the best table for creation of the binocular eye. It is based upon the coordinated groups, the creation and the directing of the binocular eye.

The fourth step is to realize that the symptoms of ocular imbalance, the phorias especially, are influenced by fatigue elements. I believe it was in 1895 that we presented a paper on asthenopia as a fatigue neurosis, and compared it to "writers' cramp" and other fatigue neuroses. Like them it is divisible into spastic and neuralgic types. The evidence offered is that it is the central coordination which fatigues; and not the muscles since the latter may be used for other acts and other rotations without distress.

Another point is that prisms wrongly placed or exercises wrongly done will often relieve distress temporarily. This is due to the rest afforded the coordination by the change. Therefore the bodily state, as to endurance, autointoxication, hygiene, ventilation and all such measures, have direct influence upon ocular comfort in imbalance; but especially the amount of use, i. e., the abuse of the eyes for fine work. The next step is to realize why prisms relieve, and why the relief is but temporary; never leading to cure, —only to palliation. I have discussed this in detail in previous papers and I have already taken too much time.

CONCLUSIONS: The **nonoperative way** to correct heterophoria and heterotropia (and it will help just in proportion to how early it is begun) is over the ciliary arc reflex loop upon which we have been dwelling so much.

That is to say, in the "eso" types we may reduce the ciliary stimulus to convergence by plus lenses giving full correction of distance error. Then, if needed, the adding of plus lenses for near as suggested by Linn Emerson or by creating continuous artificial myopia by the constant wear of over

correction with plus lenses for near and far, as I have advocated.

The way to increase the convergence side, is by the positive stimulus afforded by minus lenses, loading the accommodation, creating artificial hyperopia, sending in afferent impulses to stimulate the coordination. Prisms will do none of this because they are not acting on this reflex arc.

The operative way to correct, failing in the nonoperative, is over the dominant muscles of the groups; and the muscles of election in my practice are the internus and the externus for lateral deviations. One should be governed by tropometric measurements in this. The superior rectus is elected for correction of tiltings and for hyperphorias. There is not time for details on this, nor for the application of the anatomic elements.

We have endeavored to deal with principles; and principles, well understood, make therapy a matter of detail. We cannot go far wrong if we are right in fundamentals.

I apologize for not being more concise. There is much to be said and much work to be done. We must take all viewpoints. We must study all of the elements. Be like the spider in our attack and go on all of our legs! We can't go far on one.

NOTES, CASES AND INSTRUMENTS

TUBERCULOSIS OF THE CONJUNCTIVA

DAVID H. COOVER, M.D.

DENVER, COLO.

Mabel M., age eight months, was admitted to the Children's Hospital on March 11, 1919, with the foilowing history:

Had double pneumonia a month before coming to the hospital. During the attack of pneumonia, had an ulcer on the cornea of right eye which perforated. She was very poorly nourished and emaciated.

The lids of the right eye were quite swollen and thickened. Considerable mucopurulent discharge. Small staphyloma of the cornea. Ocular conjunctiva quite red. On the upper tarsal conjunctiva, there was a necrotic ulcer involving one half of the tarsus. The edges were very irregular, thickened, and of a dirty gray color. The base of the ulcer was covered with grayish exudate. The conjunctiva was studded with numbers of small nodules, yellowish in color, resembling tubercular deposits. On the lower lid of the same eye, there were also, a number of these yellowish nodules, some of which had coalesced and formed an ulcer of the same character as on upper lid. The tarsal conjunctiva of both lids was covered with an exudate, which when removed, bled quite freely. (See Color Plate III, Fig. 2.)

The physical examination was negative; Wassermann negative; von Pirquet negative. The conjunctival secretion showed no specific germ. Throat culture also negative. Pulse very rapid, and temperature varying from 100 degrees to 102.

On the affected side, the preauricular, submaxillary, and cervical glands were very much enlarged.

A piece of the ulcer was excised and examined by Dr. Wm. C. Finnoff, and found to be tuberculous. Both the characteristic structure and bacilli were present.

The child died ten days after she was admitted to the hospital. No autopsy could be held.

EXCISION OF THE LACRIMAL SAC.

WM. CAMPBELL POSEY, M.D., F.A.C.S.,

PHILADELPHIA, PA.

(Read before the Section on Ophthalmology of the Philadelphia College of Physicians, Nov. 20, 1919. See p. 221.)

Before Meller gave us his precise and elaborate account of his method of removing the lacrimal sac, that procedure, in my hands at least, was one of the most unsatisfactory one was called upon to perform upon the ocular adnexa. With bleeding uncontrolled, one groped about in the spurting and welling up blood from around the hidden sac, making desperate attempts at its removal with frantic jabs of the scissors. It is no wonder that the removal of the sac in those days found favor with but few. But with the hemorrhage controlled in the manner indicated by Meller, the removal of the sac by careful dissection, has become a most interesting and satisfying operation.

First, a word as to the method. All operators have their individual idiosyncracies and after performing any operation a number of times, it is more than likely that each surgeon will depart somewhat from the model erected for his guidance, yet I am convinced that the more rigidly one adheres to every detail of the directions outlined by Meller, as found in his Ophthalmic Surgery edited by Sweet, the easier will the sac be removed and the better the result attained, for the entire description is a marvel of lucidity and exactness.

My individual deviations from this description are few. Novocain in 2% solution is substituted for cocain, as being less toxic, and the solution is injected with an ordinary hypodermic needle instead of with a Pravaz syringe. Not infreqently, also, if the in-

jections have failed to control all the hemorrhage, a few minims of a solution of adrenalin, 1—2000, are injected along the lips of the wound.

As the years have gone by and experience gained, I have ceased searching so steadfastly for every layer of tissue, and have with some freedom cut more deeply, searching particularly for the internal palbebral ligament. So soon as this structure becomes visible, the position of the sublying sac is secured and its dissection in most cases easily attained. In some instances, and this is especially true when the sac lies deeply, the separation of its outer wall from the orbital tissues is quite difficult and must be done with considerable caution to avoid entering the orbital fat, or perforating the walls of the sac.

As stated by Meller, the tissues about the apex of the sac are especially vascular and the severing of that part of the structure from its surroundings is frequently followed by profuse bleeding. It is well, therefore, to make this step the final one and to divide all other connections of the sac previously.

After the cavity has been thoroughly dried, I have found it desirable to carefully inspect the fossa from which the sac has been excised, for any remnant of sac tissues, and to remove the same before closing the wound, for the smallest piece of retained mucous membrane interferes with healing. Likewise it is well to thoroly curette curette the mucous membrane of the canaliculi after these latter have been slit up, for it not infrequently happens that ectasias distend their lumen and increase the surface of mucous membrane lining them. If some of this mucous membrane is left, a troublesome mucopurulent discharge will persist, even though the sac itself has been successfully removed. In sewing up the wound, I do not aim specially to reunite the severed ends of the tarsal ligament, but coaptate the edges of the entire wound as carefully as possible with interrupted sutures. I observe Meller's injunctions regarding the dressing, but remove the stitches on the third day. A bandage is applied for one week. Most cases heal by first intention and some months later. In only a few has there been a trace of scarring. In one case a rather disfiguring keloid supervened.

I advise the removal of the sac in all cases where there is a mucopurulent discharge from the sac, and in all mucoceles where pressure fails to squeeze out the contents of the sac either into the nose or the conjunctival culdesac; also of all infected sacs prior to any operation which necessitates an incision into the globe; also all cases of neoplasm or suspected neoplasm of the sac.

The results of the operation, in so far as it removes the source of the irritating and annoying discharge into the conjunctival culdesac, are usually very satisfactory. In some cases where some particle of diseased mucous membrane of sac or canaliculus has been overlooked, the discharge persists and further treatment by curetting, cauterization or dissection is necessitated. But in most instances the irritation of the conjunctival mucous membrane is relieved and the most the patient will complain of is undue tearing after psychic or mechanical irritation of the lacrimal gland. The annoyance of this symptom varies according to the nervous susceptibility of the individual. Some advocate the removal of the lacrimal glands for its relief. I have never had recourse to this, having been usually successful in persuading the dissatisfied, that time will do much to alleviate the annoyance of which they complain.

Removal of the sac gets rid of a diseased structure, but it does not restore the lacrimal apparatus to a normal condition. Indeed it annihilates for all time the excretory mechanism. Any operation, therefore, which permits of the restoration of the mucous membrane of the sac to a healthy condition and establishes free and permanent drainage, should be regarded with favor and receive proper trial in selected cases.

I have never attempted to establish intranasal drainage; in the first place, because I am not a nasal surgeon and lack the special training necessary for its proper accomplishment; and I have not referred my cases to a rhinologist for this purpose, not only because, so far as I know, there is no one in this city who has practised this method, but also for the reason that such procedures did not appeal to me as being practical. I did not doubt the feasibility of draining the sac into the nose, but I questioned the influence of nasal conditions in the sac, and the possibility of maintaining a healthy mucous membrane in the the sac and free drainage into the nose under such conditions.

BURN OF BOTH EYES BY SALT OF COPPER

HOWARD F. HANSELL, M. D.

PHILADELPHIA, PA.

Mr. W., 55 years old, was severely burned by an explosion October 12, 1919, He was brought from his home in an inland town immediately to the Jefferson Hospital. He presented a most peculiar appearance. The lids were swollen and discolored. The conjunctivas over their entire extent, even up to the fornices, were overlaid with a foreign substance, smooth and dark. The same material covered the corneas, excepting a small area in the center of each. Vision was reduced to seeing large objects. The skin of the face was involved in many places and in these superficial wounds was deposited the same dark material. The man was suffering from shock and the fear of blindness and the usual symptoms of severe ocular burn.

Dr. Hinkel, his physician, stated that the exact composition of the explosive was unknown; that the patent belonged to a German living in America, who had been commanded by his government not to divulge the secret under penalty of death, and being a loyal son of the Fatherland, kept the secret. The invention was used to cap matches which were exploded in the mines by electricity, and their superiority over all other matches was conceded. They invariably exploded when the current was turned on and could always be depended on. No instance of failure has ever been recorded. Even a layman may understand that this is a life saving invention and in great demand in all quarries and mines. Its main constituents are a salt of copper and ammonia, welded by acetylene gas. The patient after having reduced the compound to a dry, coarse powder was engaged in crushing the little lumps with a spatula. Without warning the mass exploded.

The palpebral conjunctiva and the cornea were hidden from view except the pupillary area of both corneas by a dark blue, thin, smooth layer of the explosive. With a damp wisp of cotton rolled on the end of a tooth pick this material could be easily removed in little pieces. The epithelium of the cornea and conjunctiva came away with it, leaving a raw and bleeding surface. The unwounded portion of the cornea preserved its epithelium but had lost its transparency because of a superficial infiltration. The eyes were cleansed and the black layer of foreign substance with adhering conjunctiva and corneal epithelium was removed. Ice compresses, atropia and fluid vaseline were ordered. The inflammation and edema of the lids and skin of the face gradually subsided but the corneal infiltration increased and both corneas became entirely denuded of their epithelium during the following ten days. The treatment was continued at his home and on the 18th of November he was again admitted to the hospital for superficial, central corneal ulceration. A low grade of iritis had developed in the left eye. Under atropin, dionin, hot compresses and frequent cleansing of the conjunctival sac with mild antiseptics the inflammation subsided and the ulcers healed, with the exception of a small area in the center of the right cornea. A small symblepharon had formed in the conjunctiva of the right side.

The features that prove of greatest interest in this case are the character of

the injury and the prolonged recovery. From the man's description of the accident I infer that the material that he was powdering was not hot and therefore the injury to the eyes was not strictly a burn but a destruction of the epithelium and parts immediately beneath it by chemical action. The dark, smooth layer of foreign substance was a salt of copper, probably the oxide, which, lying in intimate contact with the superficial tissues more or less rapidly destroyed them.

The appearance of the eyes after the layer of copper was removed was so much more favorable than could have been expected that recovery in a few days seemed assured. Recovery, on the contrary, was protracted and imperfect. After two months, vision equalled counting fingers at a few feet. The impaired vision was due to infiltrated and ulcerated corneas. In the left eye, in which the erosion seemed to be less severe, vision was improving from day to day.

The prolonged inflammation in the cornea as exhibited by this patient reminds one of the "recurring erosion" of Fuchs, described first in 1872 by Hansen and later by other European and American ophthalmologists. The resemblance is not striking. In the case above recorded there is absence of the sharp pain and of the formation of blebs characteristic of recurring erosion, but there is alternate loss and regeneration of epithelium, the cause of which may be looked for in the partial destruction of the lymph spaces of the cornea and the vessels of the pericorneal ring and probably also mechanical interference with the function of the corneal nerves.

The case is, in my experience, unique and in the progress of the affection has pursued a course different from that of other cases of burns. The recovery has been incomplete, the convalescence prolonged and the anatomic changes, at first superficial, later involving the deeper tissues, all of which reflects doubt on the wisdom of the treatment, but offers no suggestions as to a more beneficial therapy.

RECURRING KERATO-CONJUNCTIVITIS FOLLOWING EXPOSURE TO DICHLORETHYLSULPHID.

JAMES H. MCKELLAR, M. D.

LOS ANGELES, CALIFORNIA.

The following case is reported, owing to the apparent rarity of recurrent inflammation of the ocular structures, due to exposure of the eyes to the action of mustard gas (dichlorethylsulphid), in spite of its intense primary inflammatory results. In fact I have been able to find only one reference to recurring attacks of inflammation of this nature or even partly of this nature, and that in [1]Circular I, issued by the Division of Ophthalmology, Headquarters of Medical and Surgical Consultants, A. E. F., France, in which attention is called to relapses of mustard gas inflammation of the eyes, self induced. The patient whose case is reported here, however, was out of the military service at the time he was under my treatment, and I did not believe him to be a malingerer. Verhoeff, in discussing Derby's paper at the last meeting of the American Ophthalmol. Soc. (A.J.O. v. 2 p.), speaks of the irritability of eyes that have suffered from gassing.

Another reason for reporting this case is the thought that it may suggest a possible etiologic factor in some cases of keratitis and conjunctivitis in returned soldiers.

Report of Case:—June 9th, 1919.

V. H. B.—Clerk, age 26, recently discharged from military service. His general health is good. His previous history, general and ocular, is unimportant until after entering the service, except that the margins of his lids were generally red. There is no history of tuberculosis, either personal or family, and the Moro skin test is negative. The patient states that on the night of September 24th, 1918, near Thiacourt, while on guard duty, he was exposed to mustard gas. The following morning his eyes were very badly inflamed. He was sent to a hospital where he remained five months, although the attack of eye inflammation lasted only about six weeks.

He had a second attack of inflammation at Brest, March 20th, 1919. The right eye only was affected and the attack was over in a week. He had a third attack at Camp Dix in April, which was about one week in duration.

History of present attack: Three days ago the eyes became violently inflamed, especially the right. This is the fourth attack.

Symptoms: Eyes feel much as they did in the first attack of inflammation, immediately following the gassing. Patient complains of pain, tearing, very marked photophobia, inability to use the

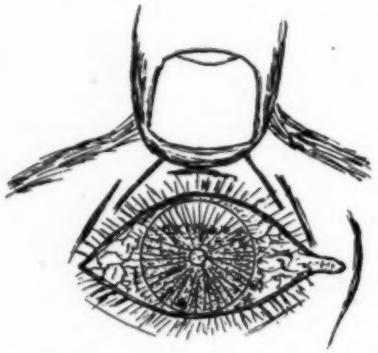

Fig. 1. Diagram showing distribution of corneal lesions due to dichlorethylsulphid.

eyes at all. The symptoms are much more marked in the right eye.

Examination: R.—Patient keeps this eye tightly closed in ordinary office day light, and resists any efforts to separate the lids. There is profuse lacrimation, no purulent discharge. The palbral conjunctiva is swollen and very hyperemic but not granulated. The ocular conjunctiva is greatly injected and ciliary injection is present. There is a superficial ulcer, one half mm. in diameter on the cornea at the lower limbus. See Fig. 1.

The anterior surface of the cornea is roughened in the area of its lower three-fourths. The upper part of the cornea, the portion normally protected by the upper lid is perfectly smooth. No distinct break in the corneal epithelium, however, can be detected except at the location of the before mentioned ulcer. Vision in this eye equals 5/30.

L. The condition of the conjunctiva in this eye is much the same as in the right, tho the inflammation is less severe. There is no involvement of the cornea of this eye. The vision of the left eye is 5/4.

Treatment: Atropin sulph. instillations. Hot compresses every three hours, followed by instillations of argyrol 20% solution.

Progress of the case: June 11th, 1919, Eyes feel much better. The cornea is smooth in each eye.

June 13th, 1919. No pain is present in either eye. Photophobia is practically gone. The cornea of each eye is smooth. The ulcer is healed.

Vision: R. 5/4; L. 5/4.

June 25th, 1919. The patient has another relapse in the right eye. The symptoms, objective and subjective, are much milder than in the previous attack.

Treatment: Similar to that used in attack described. The symptoms lasted four days.

July 1st, 1919. Eyes appear normal except for slight conjunctival injection.

October 3rd, 1919. Patient reported today at my request. He states that he has had no further trouble with his eyes since June. His eyes appear normal, save for redness of the lid margins. This condition of redness, according to the statement of the patient, was present before he entered the service.

LYMPHOSARCOMA OF ORBIT, PROBABLY WITHIN THE CAPSULE OF TENON

HARRY V. WÜRDEMANN,

SEATTLE, WASH.

Unusual size, shape and position of a large intraorbital growth, removed without enucleation of the eyeball.

Tho relatively uncommon, every ophthalmic surgeon has seen these neoplasmata and some of us have had the opportunity to operate.

In the case of intraocular tumors it is necessary to remove the eye; in orbital growths complete exenteration of the orbital contents should usually be made. In a few of the latter, the chance has been afforded of saving the eyeball

with vision, in most of which with resection of the bony parts of the orbit by the Krölein-Danis or other operation. It is rare indeed that an extensive tumor of the orbit can be removed in toto without likewise sacrificing the eyeball. The following case has a number of unique points which render its record in print valuable:

A. N. F., aged 75, consulted me Sept. 9th, 1919, account of vision and protrusion of a growth under the left eyeball causing slight exopthalmos and double vision. Patient otherwise well preserved. Vision, right, 1/60; with glasses 6/20; vision left, 6/60. Right fundus normal; Left, optic disk congested; eyeball directed slightly upward; vertical diplopia.

Examination nose and sinuses negative, confirmed by X-ray. B. P. systolic, 160; diastolic, 75. Heart normal. Urine examination normal.

What was apparently a small movable tumor of the orbit, approximately 20 mm. in breadth and a little less in height was found under the eye. Patient advised that same could probably be removed then with preservation of the eyeball; advice at that time was not accepted, but returned nearly two months later, Nov. 6th, 1919, with great exophthalmos and edema from further growth of tumor. With some hesitation, advice was given for operation with the idea that removal of eyeball would have to be done. Nov. 7th, 1919, Columbus Sanitarium, with Dr. Macbeth assisting, and Dr. Brookbank giving anesthesia, preparatory incisions for exentration of the orbit were made, i.e., a full canthotomy and sweeping incision thru the conjunctiva and orbital tissue under the globe by which the outer aspect of the tumor was observed when it protruded like a turtle's head coming out of the shell. Exploration of the depths of the orbit by the gloved finger was made and to our surprise it delivered itself in its capsule, the only adhesions apparently being to the orbital tissue, to Tenon's capsule and to the tendon of the inferior rectus muscle. These adhesions were dissected away with a small amount of orbital fat. As full exploration of the orbit showed no enlarged glands and apparently no involvement of the tissues, the wound was sewed up and a drain inserted, full healing taking place in two weeks when the patient returned home; there being slight degree of exopthalmos and double vision.

Fig. 1. Patient suffering from lymphosarcoma of left orbit.

The tumor was apparently within Tenon's capsule about the size of the first two joints of the surgeon's forefinger, of a similar shape, rounded and smooth at the apical end, its surface smooth all the way up to its external end, the latter of which was nodulated and attached at the upper surface to globe. This tumor lay

lengthways of the orbit within the capsule just as if a finger had been pushed below the eye and the first two joints left therein; an extraordinary form and position, and was really a "floating" tumor.

On section it cut like liver, showing a complete capsule around it; the report of the pathologists being as follows: "The weight of tissue after fat had been dissected free from tumor was 10 grams. The tumor measured 4 cm. in length and 1½ cm. in thickness. This specimen must be stated as being a hyperplastic lymph node, a lymphosarcoma or small round cell sarcoma. It is composed of small round cells with a scarcely perceptible stroma. No lymph follicles are in evidence. The nodules adjoining the main tumor are of like structure."

Dec. 10th, 1919, altho only a little over one month is passed since the operation, there has apparently been no return of the growth as yet. It is possible that the neoplasm arose in a lymph node and was isolated.

SOCIETY PROCEEDINGS

COLORADO CONGRESS OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

Ophthalmic Transactions

August 4-5, 1919.

The Capsule in Cataract Extraction.

EDWARD JACKSON, Denver, pointed out that the capsule of the crystalline lens varied in thickness at different distances from the center of the pupil. If it had the same index of refraction as the lens its refractive effect would be that of a concave lens of 0.12 to 0.25 D. Irregular thickenings, forming nodules, such as are found on other hyaline membranes and have been observed with hypermature cataract, might produce a dispersion of light comparable to that of ground glass.

The capsule itself is passive, whatever changes occur in it must be due to the epithelium adherent to it, and to other tissues that become associated with it. In the senile eye the changes due to epithelial activities are probably very slight. The membranes developing in the pupil after cataract extraction have for their most important constituent connective tissue, developed from fibroblasts furnished chiefly by the iris. The density of such membranes after cataract extraction is connected with the severity and persistence of postoperative inflammation.

Such inflammation is largely due to lens substance, remaining in contact with the iris. It is generally absent after intracapsular extraction, after thoro routine irrigation of the anterior chamber following extraction; and also after the operation with peripheral capsulotomy, when all cortex left within the eye is left in the capsule and not in contact with the iris. Such a capsulotomy is made by bringing the back of the knife into the corneal incision, withdrawing it until the point is at the edge of the pupil and making a puncture in the capsule as wide as the pupil. The capsule then easily tears sufficiently to permit the exit of the lens. Satisfactory clinical experience with this method had been reported previously.

DISCUSSION: Marcus Feingold, New Orleans. The superficial incision mentioned by Jackson has other advantages, not so far brought out. Secondary cataract is also produced by the fact that the little blood left in the anterior chamber after a cataract extraction is likely to lead to very dense opacity in the capsule. Blood left in the anterior chamber will be easily absorbed over the surface of the iris itself, thru the crypts, but over the lens capsule it will be absorbed less readily. If there is an opening in the lens capsule it is likely to lead ultimately to rather dense opacity. If we would all use the peripheral incision recommended by Dr. Jackson, we should be less subject to opacity from hemorrhage in the anterior chamber.

Arnold Knapp, New York. The method used by my father, Herman Knapp, for many years has the advantage of avoiding adhesion of the capsule to the lips of the wound. It does allow of secondary cataract. My father did not consider a cataract operation complete until he had done a secondary operation. Personally, I think that in cutting the capsule it is important to get a large opening, to render retained cortex freely accessible to the aqueous. The histology of secondary cataract seems to me to show it definitely to be due to proliferation of the capsular cells, which are apparently converted into connective tissue. The secondary cataract in many cases is not due so much to formation of secondary membrane as to wrinkling of the posterior capsule. It is not possible to guarantee that secondary cataracts will not follow in any case by any method. Using the capsule forceps, you do not know how much of the capsule you remove, but are liable to have tags left which may cause complications. The Kalt forceps, forming a cup and without teeth, avoid this difficulty, because you are able to remove the largest amount of anterior capsule possible by any procedure. And yet it is not possible to guarantee that secondary operations may not be necessary on account of wrinkling of the posterior capsule.

Melville Black, Denver. For a number of years I used the cystotome, and it seems to me that after I began to use the capsule forceps I was better pleased than I had ever been with the capsular results. I have used a number of different capsule forceps, but still go back to the Knapp forceps, which is a very convenient instrument to use. The large opening left by the forceps is quite noticeable, and I do not believe I do a secondary operation in ten per cent of my cases. It also seems to me that I have had less reaction after the operation by this method.

F. E. Wallace, Pueblo. I bent Knapp's forceps and made the shaft malleable so that it could be bent in any direction. I made a V-shaped incision at the sides, and then the Knapp opening above. But still in a number of cases we have to have a secondary operation. For a simple wrinkling I think the Knapp needle knife still the best instrument to use; but if we have secondary inflammation some other operation is desirable, such as the V-shaped operation with the Ziegler knife. If the secondary cataract is very dense, then the method advised by Fox is one of the best. Another excellent method is that of Knapp, puncturing the membrane, and then removing a portion of the capsule or iris with the hook.

Edward Jackson (closing). Dr. Knapp mentioned occlusion of the capsule incision. I am satisfied that this occurs. In one case where the lens was extracted for very high myopia, and a large amount of clear cortex was left, it became hazy immediately after the operation. But it was not disturbed for some time, and after some weeks there was a distinct clearing, so that more reflex could be obtained. As Dr. Black says, the removal of the anterior capsule leaves a clearer opening. But I have a good deal of faith in the ability of the eye to deal with remaining cortex. In nine cases out of ten, before many weeks the bulk of the cortex would be absorbed. The eye often continues to clear for a long time, so that the pupil may be clear at the end of six weeks.

I am skeptical as to the opacity arising from the cells of the anterior capsule. I think Parsons is correct in believing it to arise from fibroblasts derived from the iris. The presence of blood as referred to by Dr. Feingold as favoring the development of fibroblasts, is perhaps responsible for some of the thicker membranes. As to the danger of secondary glaucoma from included capsule tags, as mentioned by Dr. Knapp: this is the probable cause in the majority of cases of secondary glaucoma after cataract extraction. There are now enough lenses being taken out in the capsule to furnish valuable information, which we lack, as to the condition of the capsule in senile cataract.

The Capsule in Secondary Cataract Operations.

L. WEBSTER FOX, Philadelphia. My experience leads me to believe that where we have a thoroly mature cataract, secondary complications follow in only about 25 per cent of the cases. It is in the immature cataracts that the percentage is reversed.

Having had the opportunity of seeing the Vienna, French and English methods and practising all of them, I shall briefly describe them in turn.

In Vienna, at the hands of that skilled operator, Mauthner, we were taught to use the Langenbeck knife; a delicate sickle-shaped instrument of which the Ziegler knife is a model. Arlt, Stelwag and Fuchs used knife needles and delicate needles lacerating the capsule by such means.

In Paris, de Wecker, Landolt and Panas had different methods. De Wecker made a vertical incision with a broad knife needle thru the cornea and capsule, one or two lines from the inner margin in the right eye, and on the outer side in the left eye, operating from the front. Then with a de Wecker scissors entering this incision, passing the blade in front of the capsule in the anterior chamber and second blade behind the capsule, with one cut of the scissors making a wide opening in the obstruction.

Landolt and Panas used knife needles as well as the Bowman stop needle.

In London we were taught to follow the method of Sir William Bowman—to use two needles to open the capsule. These needles are now so well known as the Bowman stop needle, that I shall not describe them. Not all the London operators used this method. Some used the modified Langenbeck, others the de Wecker method; but the majority followed the teachings outlined by Sir William Bowman.

Having had experience with all these methods, I have for many years followed de Wecker's teachings, that is making a vertical incision thru the cornea and capsule with what is known as the English broad needle, then snipping the capsule with a small de Wecker scissors.

My reasons for selecting this method are freedom from using force in lacerating the capsule; and no pulling on the ciliary body, which is an important factor in causing cyclitis. That with a single knife like the Langenbeck or Ziegler this complication would probably not take place in a translucent capsule, goes without saying, but it is certainly a factor in dense capsules.

The Bowman stop needle has its advantages, that not much traction is used on the ciliary body in making a clear opening in the media. But the two punctures in the cornea may be two foci of infection and as needles do not cut the cornea but make a puncture which bruises the fibres of the cornea at their entrance, I have long ago discarded this method, as I look upon it as being not without risk, especially in those cases where the primary operation was delayed in healing. Having eliminated all the causes which may lead to trouble, I now only follow the de Wecker method as described above.

Some critics may consider that the vertical incision in the cornea lends more space to infection than the smaller apertures made by the more delicate instruments. In rapidly healing cataracts I take no other precautions than are usually followed in my cataract operations, but in a slowly healing cataract, I add to the usual care of asepsis, a 5 per cent solution of trichloracetic acid applied to the lips of the incision.

Another important factor is when to perform a secondary operation. In rapidly healing cataracts two to three weeks has been my selection and I have been successful. Where the time of healing has been lengthened, I wait six to eight weeks, and where the patient has 20/40 to 20/50 vision or thereabouts, and there is no particular urgency for reading or near work, I postpone the operation even up to six months. I wish to state that I take all the precautions for this operation that I do in the primary cataract operation.

Observations on Refraction.

This paper, read by I. W. Haughey, is published in full on page 197.

DISCUSSION: W. H. Crisp, Denver. The most difficult problem in connection with refraction is the teaching of the subject. Most men are given a very small amount of initial teaching, and are then left to "pick up" the work for themselves. The only way to get a proper general training of refractionists is to give a great deal of individual instruction in each case. This of course can only be satisfactorily accomplished by spending a great deal more money on the teaching of refraction than is done at the present time. Unfortunately, leading refractionists do not even agree thoroly as to methods, either in examination or in prescribing.

The principal errors in refraction work are: (1) undercorrection of hyperopia and astigmatism; (2) inadequate precision in ascertaining the axis of an astigmatic correction; (3) carelessness in balancing the amount of correction given for each eye; and (4) the overcorrection of myopia, or the substitution of a myopic correction for a hyperopic.

The frequency of occurrence of latent hyperopia is commonly overestimated. In the majority of cases which I examine there is really no latent hyperopia, that is to say no hyperopia which cannot be discovered without the use of a cycloplegic, if sufficient care and proper methods are employed. A great help in the revealing of the full amount of hyperopia, and one by no means generally resorted to, is bilateral fogging. It is often possible by simultaneous fogging of both eyes to discover a considerably greater amount of hyperopia than is found by unilateral fogging. By bilateral fogging, moreover, one is able to balance the two eyes much more accurately, in the very usual type of case in which visual acuity is possessed by both eyes.

The problem of the correction of what most men call latent hyperopia is really the problem of obtaining gradual relaxation of accommodation. I have found few patients who were really conscientious in constantly wearing their lenses who were unable finally to relax their accommodation for a full correction of hyperopia. But persistence is absolutely necessary for this, and cannot always be obtained. I do not agree with Dr. Haughey as to the correction of hyperopia in children, as in a great many instances its full correction is just as essential as in adults. In children, moreover, a full correction of all the hyperopia found, even under cycloplegia, is usually much more readily tolerated than in adults.

Whether hyperopia is the normal condition or not, it is unquestionably capable, even in small amounts, of producing marked symptoms which are ordinarily completely relieved by its correction. Since on looking away from close work the hyperopic eye is unable to obtain that condition of rest which is obtainable by the emmetropic or properly corrected eye, even moderate amounts of hyperopia represent in my opinion an imperfection of adaptation of the eye to modern requirements.

A half meter is a very convenient distance for retinoscopy, and a convenient way to check one's distance from the patient is to have a string a half meter long attached to the retinoscope. As regards the wearing of tinted lenses, I agree with Dr. Haughey in the main, and am further of the opinion that most people who demand tinted lenses do so because they have been incorrectly refracted. The accurately refracted eye is not ordinarily unduly sensitive to changes of light, altho during very long exposure to intense light the tinted lens is a comfort.

Edward Jackson, Denver. Two recent cases suggest the inability of some ophthalmologists to think that there may be anything unusual in a particular case. One was that of a woman who was doing close work, wearing a plus 4.50 diopter correction, and yet with the bilateral fogging method mentioned by Dr. Crisp she took 5.50 diopters. The only way to succeed in diagnosis is to assume that

the case is an unusual one, and to be sure that you look well beyond the possibilities of it.

J. L. Sutherland, Denver. I find that the personal equation is important in many cases. I did not hear the essayist say what he would do in a case of hyperopia in one eye and myopia in the other. I have had two cases of this kind within the past few weeks. In one case of this sort the patient had been unable to wear the lenses previously given, and I corrected each eye just as I found it, with the result that she has been comfortable for three months. I am sorry to read in our journals of ophthalmology so many diverse opinions of many men, especially in the same issue of the paper. If we are sure we are right in the measurement of hyperopia I believe we should give the full correction in every case.

Melville Black, Denver, compared refraction with fishing, and suggested that there were only born refractionists and only born fishermen, and that the two qualifications were not always combined in the same person. He had used for many years the method of estimating astigmatism described by the author of the paper, and believed to be a first class method.

F. E. Palmer, Sterling, Colorado, described a case of marked astigmatism in which he had seemed to get better results by the correction of astigmatism in the same eye at two different axes by means of cylinders ground on either side of the same lens.

I. W. Haughey (closing). As regards the correction of latent hyperopia my remarks applied only to the young, as after thirty-five years of age I believe the full correction should usually be given. The total hyperopia and the total myopia should in my opinion be thoroly corrected in such a case as mentioned by Dr. Sutherland. I have usually got about 0.25 more sphere with the retinoscope than with the chart.

Tuberculosis of the Eyes in the Army.

H. H. Stark, El Paso, Texas, read the paper to be published later.

Discussion: Edward Jackson, Denver. Dr. Stark's paper illustrates one of the very striking medical aspects of the war, at least as regards their incidence in young men. We have learned frequently the prevalence of many conditions that we did not have reliable statistics on before. This probably applies more to tuberculosis apart from pulmonary tuberculosis than to most other conditions that have been studied. The difficulty in the study of these cases is the brevity of the time that the patients were under observation. To get an idea of the complete course of such cases we shall have to rely chiefly upon cases seen in private practice. I have a case in which five years ago Dr. Knapp made a diagnosis of ocular tuberculosis in New York; and who later came under my observation in Denver, altho he has not been deemed a generally tuberculous patient.

In the cases which Dr. Stark had time to detail, the thing that struck me was the occurrence of what we should formerly have regarded as an acute iritis. We should look for syphilis very persistently in these cases, altho often that is the wrong direction, and the search is a waste of energy. We have not yet a very broad conception of the causes of acute iritis. Quite possibly in these acute cases we ought to think equally of tuberculosis as the cause. With reference to the tuberculin treatment, the point brought out by Dr. Stark as to only treating these cases once a week is very important. The improvement he had is exceptional and one that I have not had in any case. Our attitude with reference to tuberculosis will have to be that we are not certain of the cure until the patient is dead, and that we must look out for recurrences for years to come.

W. C. Finnoff, Denver. The experience of most ophthalmologists has been that it has taken a long period of time before any improvement was noticed. The great principle is cautious injection of tuberculin and observation of the retina following injection. If the injection is too large we are liable to have large hem-

orrhages and generally increased disturbance following the injection.

Arnold Knapp, New York City. Are we not remiss in these cases in not trying to find out a little more about the primary lesion? The previous history of the patient is of great importance, and another detail which we have overlooked is X-ray examination of the chest. I do not think we ought to make a diagnosis from the tuberculin test unless we get an actual reaction in the eye. Rapid improvement after injections is a cause for suspicion, that we have overlooked the true etiology. In many of these cases we have probably to do with more than one cause.

J. A. Patterson, Colorado Springs. Some of the first work in this country on X-ray examination of the chest was done by Solly of Colorado Springs; and it has now become a routine practice among the men of Colorado Springs who do tuberculosis work.

Dr. Stark (closing). I fear I have often persisted with treatment for syphilis when the condition was really tuberculosis. I believe with Dr. Knapp that we must not depend merely on the temperature and the skin reaction; but must have with these the reaction in the eye. All my cases in private practice are gone over by an expert, and where he thinks there is any doubt an X-ray of the chest is made.

Unusual Fundus Condition.

W. C. FINNOFF read the paper published p. 161, and exhibited the sketch reproduced in Plate III.

DISCUSSION: Marcus Feingold, New Orleans. If I had not asked Dr. Finnoff beforehand whether his picture represented a direct view of the fundus, I should have said that I had seen similar cases before in my own practice and in the literature. The cases in the literature, and those which I have seen, are all directed downward; and they are easy to explain if we think of the embryonic cleft in the choroid, but to explain Dr. Finnoff's case is much more difficult. It has been proven that the eye during development rotates in the orbit, so that the cleft is temporarily turned in some instances, but it is hard to believe that the eye might have made a rotation upward of one hundred and eighty degrees. (See page 161.)

Observations on Trachoma.

L. H. BUXTON, Oklahoma City, reported some of his personal experience with trachoma.

DISCUSSION.—J. J. Pattee, Pueblo. As to the doctor's statement about the high percentage of errors in data pertaining to the incidence of trachoma, my experience and observation, tho limited, correspond with his. For five years I practiced at a miners' hospital at Gallup, New Mexico, near the Navajo Indian Reservation. I saw many Indians from the reservation and a number worked for the company I served. There were many cases of external eye affections, including some trachoma, but most of the cases were old standing neglected conjunctivitis and blepharitis. Trachoma was not more frequent than among other races correspondingly dirty and unhygienic. The type of physician employed to care for the Indians was, as a rule, one who knew very little about the eye and whose duties were general practice and administration. Great reliance should not be placed on their figures pertaining to trachoma.

Trachoma should be carefully diagnosed. If a child is excluded from school, if a man is excluded from employment by an industrial organization, or if a patient is refused admission to a general hospital on the ground that he has trachoma when in reality he has only a conjunctivitis, we have imposed an unjust burden upon the man and the community also suffers.

Many physicians, nurses, and laymen have an undue fear about so-called "granular lids," and they deprive suspected cases of privileges enjoyed by others.

J. B. Potts, Omaha. The doctor's statements about coincide with our observations of trachoma around Omaha, in the Indians and others. A squaw will come in with her husband, and h-

does not have trachoma and the children do not have trachoma, but she has had it for many years. Dr. Gifford once squirted some trachomatous material into one of his own eyes and promptly developed a pannus, which it took two years to get rid of. We always have a crop of it after the threshing season. There is a form of conjunctivitis with a very profuse growth of granules, but it is not trachoma at all.

I. W. Haughey, Aurora, Nebraska. It may be that there are two or three agents producing similar symptoms, all of these resulting cases being classified as trachoma. In my own cases I usually find trachoma in the other members of the family of a patient who has had the disease. It was reported from Lincoln, Nebraska, that fifty to ninety per cent of the school children had trachoma. They were probably reporting, as trachoma, cases similar to what I got in my own practice, which get well readily on scraping and the use of copper sulphat. They may be trachoma or they may not, but if not I do not know what to call them.

L. H. Buxton (closing). My stereotyped method of treating ordinary cases of trachoma is: first expression, crushing the large majority of the granules, destroying the trachoma bodies, but remembering that you can not do this in one application; the patient must be in my office every day; the first day after expression I scrape the lids thoroly with gauze, and each day after that; in the meantime if there is any necessity for using the forceps again I do it; and the patient does not have irritated eyes. Under this treatment you will find that the pannus is getting better, the lids getting thinner. The strange thing about copper, used right along, is that the second month is painless. I give it to the old Indians and if they follow instructions and rub their lids every day they can cure their trachoma.

Growths on Inner Surface of Each Eyelid.

ROBERT FAGIN, Memphis, presented a patient, the report of whose case will be published subsequently. The microscopic examination of a piece of the tissue was reported by Dr. Finnoff.

W. C. Finnoff, Denver. The sections from the tumors consist almost entirely of small round cells which resemble lymphocytes. The arrangement of the cells is similar to that of the germinating centers of lymph nodes. A few fibroblasts are present. They send out fine reticular strands which support some of the cells. The remainder of the cells are held together by a delicate intracellular cement substance. Several capillaries, which are made up of a single layer of endothelial cells, are seen thruout the tumor. There is a small triangular strip of stratified conjunctival epithelium in one corner of the section. The tumor cells invade the whole subepithelial tissue.

From the location of the tumors and the microscopic appearance of the sections, I would classify the tumors as lymphomas.

DISCUSSION.—Arnold Knapp. The condition would probably react unusually well to the X-ray and radium. The cells are exceptionally young in character, and I would suggest the application of the X-ray.

Edward Jackson, Denver. The first thing I thought of was hyalin changes in the lid, but the lids are free from scarring; and on seeing the sections there can be apparently no question as to its nature. I believe it would be a good case for radium in rather large doses, say from thirty to fifty millicuries. I think this is more promising than internal treatment with arsenic.

Melville Black, Denver. Outside of radium, the only thing that occurs to me would be the fulguration spark, which could be easily applied. If the application of these two agents does not produce results I should be in favor of letting the case alone.

E. R. Neeper, Colorado Springs. My experience with the use of the fulguration spark on isolated nodules of vernal conjunctivitis, was that the result was an increase rather than a decrease in the size of the nodules.

Hypotony After Trephining.

ARNOLD KNAPP, New York City, read the paper published in full, page 88.

DISCUSSION.—Edward Jackson, Denver. My experience in trephining has been very limited. I have had no case that remained below ten millimeters for more than a few weeks. The nearest approach to anything of this kind was in the first eyeball I trephined, where the tension remained below twelve millimeters for several weeks and was below fifteen millimeters after eight years. In that case there has been no marked deterioration of the eye. It was a blind eye in the first place, a case of simple glaucoma. The most rational explanation of postoperative iritis has seemed to be that it was the result of prolonged reduction of intraocular pressure. And yet the tension in such cases was often not so low as that of my case. It is probably well that we have a method by which the tension of the eye can be permanently reduced below normal in glaucoma, because I believe the changes in glaucoma are due to a change in relation of tension to nutritive processes rather than absolute increase in tension. We have cases of glaucoma in which the deterioration goes on while the tension is down at the normal level.

Melville Black, Denver. Does Dr. Knapp feel that the trephine opening in each of his cases was as far forward as he would have liked to have it? The posterior position of the opening seems a possible explanation of the persistent hypotony. Is the detachment of the choroid a thing that may occur and be only temporary? I have never personally seen a case of persistent hypotony. The tendency in all of my cases has been either to normal tension or to moderate increase in tension. It has seemed to me that in all the trephine failures I have had the opening was not far enough forward on the cornea.

Robert Fagin, Memphis, Tennessee. Will Dr. Knapp tell us his experience with the Lagrange operation, and whether he has had this hypotony after the Lagrange operation?

Dr. Knapp (closing). I think the question of hypotony and the intraocular circulation is a very important phase of our study of the subject. Personally I look upon a case with an enormously large ectatic scar and minus tension with a good deal of trepidation. I do not think that choroidal detachment has anything to do with prolonged softness of these eyes. I think you will find choroidal detachment present in the majority of these cases. I have never seen a choroidal detachment remain permanent. In trying to get a complete iridectomy in these cases I may make too much traction on the iris. As to the position of the trephine opening, Collins has shown that the success of the filtration depends upon making a complete cut in Descemet's membrane. I am further very careful to separate the superficial layers of the conjunctiva from the cornea. I have never got hypotony from a Lagrange, in fact rather a hypertony than a hypotony. I limit the Lagrange operation to cases which I get early, in which by the use of drops I can get the tension below thirty millimeters, and in which the iris is not degenerated.

WM. H. CRISP,
Recording Secretary.

SECTION ON OPHTHALMOLOGY, COLLEGE OF PHYSICIANS OF PHILADELPHIA

November 20, 1919.

DR. WILLIAM T. SHOEMAKER,

CHAIRMAN.

Operation for Draining Lacrimal Sac and Nasal Duct into the Unciform Fossa.

DR. HARRIS P. MOSHER, of Boston, read by invitation a paper describing the operation devised by him for this purpose, with a review of the anatomy of the parts involved. (See LARYNGOSCOPE, v. 25, p. 739.)

DISCUSSION. Dr. S. Lewis Ziegler said that the ingenuity and practicability of Dr. Mosher's operation should receive our commendation. There is no doubt

that a patulous tear duct can be secured in this way. West's window resection operation and Yankauer's operation also accomplish this result. There is, however, a certain physiologic drawback in all these operations. The normal capillarity of the lacrimal canal is interfered with and forcible regurgitation of septic secretions cannot be prevented when the nose is blown. This fault was also present in the older technic of extreme dilatation so frequently repeated that atrophic degeneration of the lining of the overpatulous tear duct finally occurred. Many years ago he saw two extreme examples of this latter method in which infection of the cornea, perforation and emptying of the anterior chamber would occur overnight. This accident was liable to happen at any time, and was repeated many times while the patients were under his care. Strange to say these ulcers were clear and left but slight traces of the process, while the vision was but little disturbed.

Excision of the lacrimal sac has not proved as successful in cases of dacryocystitis as one would like to see. He had several times been called on to do corrective operations where slight infection of the wound and subsequent contraction of the scar had caused a mild ectropion. This he corrected by his galvanocautery puncture operation. In other cases in which the epiphora proved annoying he performed rapid dilatation of the atresic lacrimal canal, *pro forma*, as tho no previous operation had been done and then introduced a lead style for the tissues to heal around, somewhat like the metal ring inserted in the perforated lobe of the ear when planning to wear earrings.

Dr. Ziegler still believes that rapid dilatation of the lacrimal canal *ad maximum* and without incision of the tissues is the best treatment for the great bulk of obstructive lesions of the tear duct. He recently saw two young ladies, aged twenty-one years, for whom he performed rapid dilatation (up to No. 12) when they were about two weeks old. Examination showed a physiologically patulous tear duct, permanently preserved.

He had the opportunity of seeing a number of Dr. West's operative cases when he was working in the clinic of Dr. Silex, in Berlin. He could not see that the results were better than with rapid dilatation. But he did come to the conclusion that whatever the treatment used in order to correct the lacrimal lesion a skilled rhinologist is required to coöperate in order to improve the ventilation of the upper air chamber, the drainage of the sinuses and the hyperesthesia of the nasal mucosa. In this way only can the chemically irritating and bacteria-laden hypersecretions be reduced to a normal and nonirritating condition and the physiologic balance between the nose, tear duct and eye be restored. The hyperesthetic area over the septal tubercle is the "eye spot" of the nose. By sympathetic reflexes it controls the sinus secretions. Cauterization of this area will therefore greatly reduce all such hypersecretion.

Dr. Zentmayer: It was very disappointing to learn that after the intranasal operation, as described by Dr. Mosher, probing at irregular intervals over an indefinite period is necessary to maintain drainage. It may be said for the operation of excision of the sac, that when the procedure has been properly done, treatment of the condition is at an end. It is true that, for a time, in most cases, the epiphora following the operation is annoying, but this gradually lessens and in most cases finally ceases. If after the intranasal operation probing is still required he saw no advantage in doing the operation, and believed it would gain but few advocates.

Dr. G. Oram Ring: No intranasal operation of the West type or its modifications would ever entirely take the place of lacrimal sac excision—notably in those cases of chronic lacrimal disease associated with cataract or corneal ulceration. He recalled a visit to the Silex Clinic, Berlin, which he made during 1912, at which time it was rare not to see several cases of extirpation of the sac daily. A visit to the same clinic two years later found Dr. West doing his operation at the same clinic largely to the exclusion of all others.

The method at that time was on trial, but the conviction was expressed by most

of the nose and throat men connected with the Berlin Policlinic that the nasal opening made was not likely to be permanent. They insisted on waiting at least a year or two before giving their approval to the procedure.

Dr. Posey: Meller's publication of his bloodless method for the removal of the lacrimal sac had converted that operation from a most unsatisfactory one to one of the most satisfying and interesting operations in ophthalmic surgery. He said he deviated but little from the precise directions laid down by Meller, substituting a 2 per cent. solution of novocain for cocain as being less toxic and making use of an ordinary hypodermic syringe instead of the Pravaz instrument.

Dr. Posey makes the internal palpebral ligament a valuable guide, realizing that he will find the sac lying directly beneath it. He dwelt upon the importance of the removal of every piece of diseased tissue connected with the sac also of a thoro curettement of the canaliculi. The scarring observed several months after the operation is negligible.

Dr. Posey advocated the removal of the sac in all cases in which there is a mucopurulent discharge from the sac and in all mucoceles in which pressure fails to squeeze out the contents of the sac either into the nose or the conjunctival cul-de-sac; also of all infected sacs prior to any operation which necessitates an incision into the globe; also of all cases of neoplasm or suspected neoplasm of the sac.

The results of the operation, in so far as it removes the source of the irritating and annoying discharge into the conjunctival cul-de-sac, are usually very satisfactory. Tearing, after psychic or mechanical irritation of the lacrimal gland, is the most patients complain of, and this varies according to the nervous susceptibility of the individual.

Dr. Posey said he had never had recourse to removing the lacrimal glands to relieve this lacrimation, the watering of the eye generally subsiding after a time, so that it annoyed but little. Dr. Posey said that while removal of the sac gets rid of the diseased structure, it does not restore the lacrimal apparatus to its normal condition. Indeed it annihilates for all time the excretory mechanism. Any operation, therefore, which opens up the lacrimal passages and maintains them in a patulous condition, should be given a fair trial, and he proposed in the future to refer suitable cases to rhinologic colleagues for a trial of Dr. Mosher's procedure.

Pathologic Histology of Excised Lacrimal Sacs.

Dr. G. E. DE SCHWEINITZ. Extirpation of the lacrimal sac is an operation of ancient lineage. Celsus recommended that the sac should be removed down to the lacrimal bone, which was subsequently touched with the point of a glowing iron. The same operation was commended by Galen and by Paulus of Aegina, both of whom declare that many surgeons in its performance bored thru the *os unguis* into the nose, the ancestor, perchance of those operations which in our day establish an intranasal drainage. Berlin, in 1868, gave the first impetus, in comparatively modern times, to the operation of extirpation of the lacrimal sac, now commonly and successfully practiced in many suitable cases.

His experience with this operation was a fairly large one and from it he concluded:

1. It is a good operation if its technic has been correct.

2. For a week or two the epiphora may be annoying; subsequently it markedly lessens, and sometimes practically disappears, unless the patient is exposed to wind or irritants.

3. The lessening of the epiphora does not depend upon atrophy of the lacrimal gland, but upon the disappearance of the irritation to which this gland had been subjected prior to the extirpation of the sac by infectious conjunctival secretion.

4. According to C. R. Holmes there is no serious objection to removal of the lacrimal gland in the event of continuance of annoying epiphora, and none to ablation of the palpebral portion of the gland, which is not without value in these circumstances.

5. Extirpation of the sac is of less favorable result in children than in adults, and adaptation is quicker in those

patients who prior to the operation have had complete stenosis of the duct, and in whom the overflow of tears has been correspondingly great.

The pathologic findings in excised lacrimal sacs have been often recorded. A personal research in this regard made some years ago confirmed other observations of other surgeons, referring now to various types of so-called chronic dacryocystitis. In general terms the excised tissue exhibits some form of chronic catarrhal inflammation of the sac or else acute hemorrhagic and purulent inflammation. The results of a number of these examinations may thus be summarized:

The epithelium lining the sac may be intact over its surface, but upon it are exudations of leukocytes or marked leukocytic infiltration between the cells; the mucosa is usually densely infiltrated with small round cells, sometimes massed, with eroded and degenerated epithelium over them. The fibrous coat of the sac usually shows intense injection of the vessels with hemorrhages adjacent, and areas of embryonic connective-tissue formation. In the lymph spaces of the fibrous coats the endothelium may be thickened and proliferated.

Examination of the periosteum, as in a fragment recently removed in these circumstances shows fibrinous and hyalinized connective tissue, vascular engorgement and profuse lymphocytic infiltration, which is especially marked in the perivascular regions.

Perfectly willing to be convinced that other methods than extirpation of the sac are more satisfactory, and some of the intranasal operations hold forth fair promise, it was difficult for Dr. de Schweinitz to believe that anything but a radical removal of tissue diseased as it exists in chronic dacryocystitis is entirely satisfactory. Certainly in certain ophthalmic conditions it became almost obligatory, *e. g.*, to aid in the treatment of serpent ulcer of the cornea and to render safe operations on the ocular bulb when the sac is inflamed and pussecreting.

J. Milton Griscom, M. D.,
Clerk.

ST. LOUIS OPHTHALMIC CONFERENCE

December 12th, 1919.

Dr. Wm. F. Hardy, Presiding.

Determination of the Axis in Astigmatism.

Dr. Frederick E. Woodruff said: One of the greatest difficulties in doing accurate refraction work is the determination of the presence or absence of astigmatism, and its amount, if present. Before the amount of astigmatism can be ascertained with any accuracy, the axis of the cylinder must be determined with as much certainty as may be possible.

Where there is any doubt as to the presence or absence of astigmatism much light can occasionally be shed by the use of the stenopeic slit. It is needless to explain the nature of this aid in our work and it is my purpose only to call attention to it and to urge its more general use.

When an approximate correction has been made of the hyperopia or the myopia by using spherical lenses; then, by the addition of the slit in a revolving cell of the trial frame, it may be determined very readily whether the vision may be improved in the various axes by slowly revolving the slit thru these axes. When the vision has been apparently improved in any axis, then, by the addition or subtraction of spherical lenses it may be determined whether the greatest acuity has been obtained in this axis. When this has been done again revolve the slit slightly in either direction and ascertain whether the first position was the exact axis of greatest or least refraction. When the correction in this axis has been obtained, then revolve the slit ninety degrees and by the addition or subtraction of spherical lenses again get the best acuity possible. When these two corrections have been made, remove the slit and put on a correcting combination that will represent these two measurements. This is not the end, for even here we may have to add or subtract from our combination. This method of procedure will very

often save one from the error of considering a mixed astigmatism to be a case of simple astigmatism. It also assists very materially in the determination of the correctness of any refraction. The more this slit is used the more one learns to rely upon it; as an ally, however, rather than as the sole method.

I wish to call attention to another method which has proven of the greatest advantage in the determination of the exact axis in astigmatism. After the best obtainable vision is secured by placing before the eye the combined lenses, remove the cylinder and replace it, in the supposed axis, by a cylinder a half dioptre, or more, stronger; then, by rotation, determine whether or not the vision is improved. With an intelligent patient permit him to rotate the cylinder in order to secure his best acuity. Then replace the proper cylinder in the new axis, which will prove to be the correct one. This method was called to my attention by Dr. W. B. Post of Carthage, Mo., and I have made most satisfactory use of it for a number of years and have not been disappointed in the results obtained. I have been unable to find reference to this method in the text books.

Discussion.—Dr. Wm. H. Luedde stated that the essayist's insistence that the visual acuity is the final test for accuracy in the correction of astigmatism coincides with the practice of the late Dr. John Green. Altho Dr. Green was the originator of a number of standard test cards for the measurement of astigmatism, during his later years in private practice, he rarely referred to them but depended more on the direct application of ophthalmometer measurements, and the effect of cylindric lenses on visual acuity. However, there is no reason for any ophthalmologist to limit himself to any one method; measurements should rather be checked by confirmatory test in a variety of ways.

With regard to the position of cylindric lenses, it is rarely found necessary to select an axis which is not a multiple of five. However, in a few cases the determination of the axis within one or two degrees seems to be of practical importance for the comfort of the patient.

Dr. H. S. Hughes. Most test cards are placed too high. If the test letters are about 2 feet from the floor, the direction of the gaze is slightly downward and the eyes will be more comfortable than when the gaze is directed horizontally or upward. Another point: objects in or near the line of the test range should be eliminated, as they distract the patient's attention.

Dr. W. E. Shahan stated that, personally, he had more confidence in astigmatic charts that in other means of measuring astigmatism.

Dr. John Green inquired as to the width of the stenopeic slit, and as to whether Dr. Woodruff's use of the slit was confined to tests under cyclopegia or not?

Dr. F. E. Woodruff, replying to Dr. Green, stated the slit is used in testing *both* with and without cycloplegia.

Dr. E. H. Higbee has used the stenopeic slit in testing a great deal; but of late, for no particular reason, he had not used it at all. He recognized the value of the method, and thought Dr. Woodruff's suggestion of using it more will no doubt lead to the determination of axes with a greater degree of accuracy. He always rotated, or had his patient rotate, the cylinder and found that they very often preferred the axis at from 5 to 10 degrees away from the one they designated upon the chart.

Dr. J. W. Charles. In the test with the cross, after the axis has been found, the patient should be cautioned not to attempt to make the lines alike, but simply to say *when they become alike;* many patients try so hard that, altho both meridians may be adequately corrected, they actually, by reason of attention to one or the other line, see one more plainly than the other.

Dr. John Green stated his opinion that in many cases not all the astigmatism could be corrected with comfort to the patient, at least, when the first glasses are ordered. Later they may accept with satisfaction all or nearly all.

Case Reports:

Dr. J. W. Charles. A case of *injury to an eye by a tennis ball* (1907) in which there was at first a hyphema with large pupil. When the media had cleared there was an exact simulation of a rupture of the choroid but with vision of 19/30. In 1908 the vision was still 19/30. The patient disappeared for two years, when the vision was found to be 19/15 and the exudate near the macula had vanished except for traces of pigment. The pupil is still slightly larger than that of the other eye but accommodation is sufficient for reading.

The next case was that of a bookkeeper who had never seen well with his right eye. His best vision was 23/75. Under mydriasis the ophthalmoscope yielded a picture almost exactly like the first illustration of Major Middleton's article on *"Hole of the Macula"* (Am. Journ. Ophth. Nov. 1919).

The third case was that of *embolus of the arteria centralis retinae.* The patient, a coal miner, was attempting to collect from the Illinois compensation commission for an accident, but confirmed the diagnosis by dropping dead three weeks after the examination.

Discussion: Dr. T. L. Post, in reference to Dr. Charles' second case, questioned whether this could be a genuine one of "Hole in the Macula" because of the good vision.

Dr. F. E. Woodruff recalled a patient with a hiatus in the retina, so close to the macula that the diagnosis of "Hole in the Macula" was made, but in this case the vision was very good.

Dr. W. H. Luedde stated that the possibility that atrophic changes near the macula may not be due to traumatism, must be remembered; especially in those cases where a claim for damages is pending. Such an examination recently showed slight marks of external violence on the left eye, but it was the right eye in which vision was apparently diminished by a lesion at the macula. Re-examination after several months revealed further extension of the macular lesions and the development of hyalitis. A large old retino-choroidal scar, anterior to the equator in the affected eye, and a positive Wasserman reaction gave additional cause for the rejection of the claim that the loss of vision was the direct result of traumatism.

Dr. John Green, Jr., read the collective abstract "Hygiene of the Eye" (Published in the Amer. Jour. Ophthalmology, Dec. 1919).

John Green, Jr.,
Secretary.

BALTIMORE CITY MEDICAL SOCIETY, OPHTHALMIC SECTION, CLINICAL MEETING

December 17, 1919.

Dr. E. A. Knorr, presiding.

Hemorrhage in Vitreous.

Dr. H. Friedenwald presented a case of a young man who, a few weeks ago, suddenly developed a large hemorrhage in left vitreous, and at time of first examination vision was limited to hand movements in this eye. At this time the case presented no unusual features, but later became interesting on account of the rapid absorption of the blood and the development of the connective tissue at upper periphery of retina. This gave the appearance of a localized detachment of the retina, but the retina, he believed, was not really detached. A retinal vein appeared to leave the plane of the retina, reach far out into the vitreous and enter the mass of connective tissue, but the return of both sides of the vein seemed to be in the proper position. The hemorrhage probably came from one of the peripheral retinal arteries. The case belongs to that interesting group of vitreous hemorrhage seen in young people. In this condition there is a great tendency to recurrence. In the cases he had observed there were peculiar vascular changes: a number have shown corkscrew vessels: and in all there was a tendency to connective tissue formation which seemed to be the result of the hemorrhages. In recent years tuberculosis has been regarded as the causative factor.

Bilateral Punctate Retinitis.

DR. FRIEDENWALD also presented the case of an old colored woman, with punctate retinitis of both eyes with some recent retinal hemorrhages in the right. The spots were small and white, sharply circumscribed and, at some places, confluent. The urine and the blood showed nothing abnormal. The sole pathologic condition was probably arteriosclerosis. The diagnosis, retinitis punctata albescens described by Mooren forty years ago, who considered it an aberrent form of retinal degeneration without pigmentation. Several cases have been reported in which there was night blindness, contracted field of vision, symptoms of pigmentary degeneration of the retina but without the pigment.

A second condition to be considered has been termed guttate choroiditis or verrucosities of the choroid. A few cases of this kind have been examined pathologically, and extensive areas in the choroid were found covered with these spots tho there was little visual impairment. In the case presented here, the vision is very good in the left eye, there are no pathologic changes in the optic nerves. Nettleship claims to have no difficulty in differentiating the two types described. Dr. Friedenwald considered the spots identical in both forms, and the evidence of a degenerative process, whether allied to pigmentation, degeneration, general arteriosclerosis, or when found in phthisis bulbi, it mattered not. It is probably a mistake to look upon the "white spots" as the essential trouble.

DISCUSSION.—Dr. Knorr wanted to know what relation the recent retinal hemorrhages had to the punctate retinitis.

Dr. Friedenwald considered the whole process to be one of a chronic degenerative nature, due to arteriosclerosis.

Stellate Opacity of Crystalline Lens.

DR. FLECK presented a young soldier who had a slowly developing stellate opacity of each lens with progressive impairment of vision. Vision right eye was 5/200 and left eye 8/200. Dr. Fleck presented this case principally to obtain an opinion as to the advisability of doing a needling of the lens.

DISCUSSION. Dr. Friedenwald was of the opinion that the lens should be operated on if no fundal lesion was found as a factor in producing the visual impairment.

Rupture of Retina from Contusion.

DR. FLECK also presented a soldier who had been injured in action by particles from a high explosive shell. Some fragments of the shell caused a laceration of the left lid, contusion of eye ball with a rupture of retina at left macular region exposing the underlying choroid. The case was interesting, as most cases of this type produce other extensive lacerations of the choroid and this destruction was limited to one spot.

Retinitis Pigmentosa.

DR. KNORR explained a case which had been under treatment for the past twelve years, during which time there had been little change in the condition. The case presented classic symptoms of pigmentation at the periphery of retina, beginning optic atrophy, night blindness, impaired visual acuity, a postcortical cataract, and characteristic ring scotoma. He was unable to find any definite cause for the condition. No relationship could be found between intermarriage of families.

Chronic Trachoma.

Dr. KNORR also showed three cases of trachoma in which the tarsal cartilage had been resected. All cases showed a good result.

DISCUSSION. Dr. Johnson stated that at Fort McHenry they had done quite a number of resections with favorable results. He considered the indications for operation: Thickened cartilage, corneal ulceration with pannus. In their operative technic a double arm suture is brought out and tied over the lid to preserve a permanent correction. Most all cases had been done under a local anesthetic with injection of novocain, the operation being practically painless. After the operative procedure a 1-400 bichlorid solution is rubbed on under surface of lid.

Dr. Fleck was impressed with the ease with which the mucous membrane could be separated from the cartilage after the injection of novocain.

Hemorrhagic Retinitis From Infected Tonsils.

Dr. LOOPER presented a case of a young medical student who had consulted him on October 21, 1919, regarding impairment of visual acuity in right eye. A few days before when looking thru a microscope he noticed blurring of the image, and the appearance of definite spots in his eyes. Examination showed a severe hemorrhagic retinitis of each eye, but more advanced in right. Vision right eye 1/10, left eye 2/10 with no improvement by refraction. Examination of throat showed badly infected tonsils, anterior cervical glands enlarged. Patient was sent to the hospital for the purpose of a thoro examination by an internist, who could find no cause for the condition. Blood pressure was normal, several careful urinalyses were negative, complete blood picture normal, Wassermann negative, X-ray of sinuses and teeth negative, complete physical negative, except infected tonsils.

October 26, 1919, tonsils were removed, and after one week patient began to improve. The hemorrhages slowly disappeared, and at the end of a month vision was normal in each eye, hemorrhages had completely disappeared, of which there has been no recurrence to date. Patient has gained four pounds in weight, color is gradually improving, appetite good and he feels very much better in every respect.

DISCUSSION. Dr. Friedenwald thought the case was very interesting, as hemorrhagic retinitis at this age is very unusual as well as for the rapid disappearance following the excision of the tonsils.

Dr. Knorr mentioned the association of the teeth and sinuses to retinal hemorrhages and was glad to hear and see demonstration of the infection from the tonsils being a causative factor.

EDWARD A. LOOPER,
Secretary.

ABSTRACTS

Keyser, Geo. Ophthalmia Electrica from the Manufacture of Calcium Carbide.—Norsk Magazine for Laegevidenskaben, March, 1919.

The author's cases all occurred during a test run of a new electric oven of unusual size at a carbide factory at Aalvik, Norway. Carbide is made by heating coke and quicklime together in an electric oven at a temperature of 2400° to 3400° Centigrade. Flashes of strong light due to accidental short-circuitings are thought to be the cause of the ophthalmias. Out of 12 men attending the oven in the night of August 3rd, 1918, 5 had symptoms of ophthalmia coming on within 2 or 3 hours after leaving the oven. None of the men affected had worn any protective glasses.

Four of the cases were of a milder type and presented identical symptoms: marked pain in the eyes, marked photophobia and blepharospasm; lids slightly swollen; conjunctiva much injected; cornea negative; pupils equal with a weak reaction to light; no examination of fundi; vision normal. Treated with one or two instillations of cocain solution (2%), these patients recovered in a few minutes.

The fifth case presented the same history but the symptoms were more marked. In addition the patient complained of the appearance of a vibrating golden-yellow line, seen at some distance and noticed whether the eyes were closed or open; it would disappear at times and be substituted by a blank space in which nothing could be seen. After the instillation of a few drops of cocain solution the pain and spasm disappeared but the yellow line still remained. On attempting reading, the patient could see that there were letters, but could not tell what the words were. (Central-paracentral scotoma). After 24 hours the golden

line became weaker and the vibrations slower; in 36 hours the line was gone and the vision proved normal. There was complete recovery in all the cases.

D. L. T.

E. Ehnhuus. Lesions of the Eyes as a Result of X-ray Treatment.—Hospitalstidende, Vol. 62, P. 1228.

The patient was a man of 67 with a carcinoma of the inner canthus of the right eye, which showed a few excrescences on the caruncle and on the plica semilunaris. Vision and fundus normal. From December, 1911, to December, 1912, he received 9 X-ray exposures with a hard tube, the eyeball being covered with lead. The next to the last exposure happened on the 14th of November, 1912: on the last of December, 1912, at the last exposure the patient stated that for a month the vision had been reduced and there had been lacrimation, photophobia and some secretion in eye. Vision 20/70. Examination revealed a marked injection of the bulbar conjunctiva. Cornea, iris and lens normal; optic disc blurred. Above and below disc yellowish white plaques on the retina in size about ¼ of that of the disc. Above and temporally, a peculiar flaming reddish-yellow appearance with diffuse pigmentation. On March 19, 1913, the external injection had all disappeared, the plaques on the retina were still present, but were whiter and atrophic, with pigmentation unchanged. Vision had returned to normal.

D. L. T.

Moreau, F. So-called Psychic Blindness.—Ann. d'Ocul., 1919, v. 156, p. 156.

The author defines this condition as blindness caused by an unknown mechanism, under conditions of great excitation, not accompanied by ophthalmoscopic lesions, and progressing towards cure without therapeutic measures. He reports such a case. The patient was under intense bombardment for 5 hours but was unharmed. However, he was greatly excited. Next day, his vision was normal. During the course of another bombardment, he complained of an intense occipital headache, followed by instantaneous and complete blindness without convulsions.

When seen a couple days later, there were no ocular changes, V. R. = fingers 0.5, V. L. = fingers 1.5. History showed patient had been subject to frequent nervous crises, with loss of consciousness, but without epileptiform phenomena. No muscular paralysis. Upon removal from the zone of bombardment the vision gradually returned in both eyes. No therapeutic measures were employed. The period of cure was only one month, in contrast to the usual several months or years. The author does not suggest any explanation for the condition.

C. L.

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EDITORIAL STAFF

ADOLF ALT,
Metropolitan Bldg., St. Louis, Mo.

M. URIBE-TRONCOSO,
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MEYER WIENER,
Carleton Bldg., St. Louis, Mo.

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HARRY V. WÜRDEMANN,
Cobb Bldg., Seattle, Washington.

EDWARD JACKSON, Editor,
318 Majestic Bldg., Denver, Colo.

CLARENCE LOEB, Associate Editor,
25 E. Washington St., Chicago, Ill.

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CHANGES IN REFRACTION WITH AGE

It still happens that a patient is told that if glasses are right he will never need to have them changed for far seeing. But this is so nearly opposite to the truth that most who are engaged in ophthalmic practice can disapprove it from their own experience. Astigmia is generally supposed to change less than other forms of ametropia; yet statistics indicate (A. J. O. v. 2, page 22) that, taking all ages over an average period of less than nine years, two-thirds of them show change of astigmia amounting to 0.25 D., or upward. The increase of hyperopia with age was mentioned by Donders; and the tendency of myopia to increase at certain times, in all cases; and thruout life in a few cases, is generally recognized.

What are these common changes in refraction? At what times of life are they most likely to occur, and what are the physical changes in the eye on which they depend? These are questions upon which it is of practical importance to have definite ideas; and it ought to be possible to answer them out of the experience of the profession now accumulated.

With reference to astigmia it is pretty well established that the kind called "astigmia with the rule" is more common than the opposite kind, only in early life. All statistics bearing upon the subject show that after middle age it is the exception and becomes less and less common.

At birth practically all eyes are hyperopic. They are in transition, from a prenatal form in which they would be excessively hyperopic, toward a lower hyperopia or emmetropia. This process seems to go on more or less during early childhood. Accelerated by pathologic conditions arising from astigmia and excessive near work, the tendency to lower hyperopia goes on to myopia which increases especially about puberty; and may continue to increase into adult life.

When full body growth is attained, there comes to the eyes a period of comparatively little change in refrac-

tion; tho to this rule there are many exceptions, mostly dependent on pathologic conditions, located within the eye or profoundly affecting the general nutrition. This period lasts roughly speaking from the age of 25 to that of 40 years. At this time of life, however, we are justified in telling the patient he may go several years without change of glasses, altho no immunity from change can be assured.

With the advent of presbyopia a decided tendency to change of refraction toward increased hyperopia appears. Donders recognized this, and ascribed it to latent hyperopia of earlier years becoming manifest. But we now have records of enough eyes, measured in earlier years under the most powerful cycloplegics, to know that in many cases the hyperopia is actually increased. The tendency of low and moderate myopia to decrease at this time of life is also encountered, altho it is far from being so marked or so general as myopes often hope.

After about 60 years of age there comes, in a continually increasing proportion of eyes, a tendency toward lower hyperopia, and actual and progressive myopia; the so-called second sight of old people that enables them to "read without glasses." This tendency is not manifest in all patients, but is so common among those of advanced years that we must recognize it as a general tendency of senile eyes; which balances ability to discard spectacles with loss of distant vision and actual lowering of visual acuity, and often ends in cataract.

The physical bases of each of these changes in refraction needs to be more thoroly worked out; but we already have a general idea as to what most of them are. The index of refraction of the cornea, aqueous, or vitreous, is sometimes mentioned as liable to change. But no change in the index of either of these has been observed that would be sufficient to account for the tendencies to general change of refraction referred to above. Their cause must lie in changes of size in the eyeball and lens, and changes in curvature of the cornea and crystalline lens, or of index of refraction of the latter, or change in its position.

The change of dimensions of the eye by normal growth probably underlies the diminution of hyperopia in early childhood; and overgrowth of the eye, particularly of the sclera and vitreous, usually distinctly pathologic, is the basis of axial myopia. The known instances of the opposite change, shortening of the eyeball by flattening of the cornea, following inflammation or operation, are apart from those general tendencies we are now considering.

As pointed out by Priestley Smith, the continued increase in the size of the crystalline lens from infancy to old age must, if the lens keeps the same shape, result in an increased length of focus and tendency to increased hyperopia or diminished myopia. This seems to account for the tendency in that direction exhibited in adult life, and particularly between 40 and 60 years of age. The increase in the volume of the lens certainly occurs, is sufficient to account for this change, and is equally gradual.

The curvature of the anterior surface of the cornea has been widely observed, since the advent of the ophthalmometer in clinical work nearly 40 years ago. But most of the statistics published throw little light on the changes of curvature that occur with age. We need statistics that will indicate average curvature at different periods of life; and reports of the changes that have been observed thru measurements of the same eyes, repeated from time to time for many years. But what we already know is that in the larger proportion of cases there are no changes in the curves of the cornea that can account for the changes in the refraction of the eye. Very pronounced corneal changes follow injury or disease and cause great changes of refraction. But in the larger number of cases of refractive change there is no alteration in the cornea to account for it.

Of permanent changes in the curvature of the crystalline lens we know

very little. Observation of these curves has been confined to the laboratory, has never been resorted to clinically to any important extent; and the few eyes that have been measured in the laboratory have rarely been remeasured in after years. Reasoning about it by exclusion, we may conclude that important changes in total astigmia without change in the cornea must be due to changes in the lens surfaces; but that is the only foundation we have for the assumption.

That changes in the lens associated with age do occur in all eyes, is well known in connection with presbyopia and "senile" cataract; and these include, beside growth of the lens, changes in its refraction and absorption of its cortex. In a few eyes the whole lens disintegrates and is removed. In a larger number the whole cortex liquifies. Probably in the majority of eyes that go to old age, there is some absorption of the lens cortex. In most cataracts that approach maturity the stage of swelling is followed by one of marked decrease in bulk. Sometimes the gray, or almost white cortex, disappears from the pupil, leaving the darker or brownish nucleus quite exposed.

Absorption of cortex appears to be the physical change producing senile myopia, the so-called "second sight." In the normal adult eye the refraction of the highly curved nucleus is partly neutralized by the convexo-concave layers of the cortex. As the latter are lost by absorption, the nuclear refraction predominates and rays entering thru the nucleus are focussed more in front of the retina. It is only necessary to suppose that such layers of the cortex shall be absorbed more in certain meridians than in others to conceive a sufficient cause for changes in astigmia with age, even such great changes as those reported by Zimmermann (A. J. O., vol. 2, p. 420).

Another possible cause for change in astigmia is change in the position of the crystalline lens within the eye. That such changes may and do occur has been demonstrated experimentally, in the falling of the lens toward one side or the other during extreme relaxation of the zonule during accommodation. A change of obliquity with such change of position would account for change in lenticular astigmia.

A review of the possibilities for change in the ocular refraction shows how reasonable it is to expect such changes in the evolution and involution of the eye. Experience proves that they occur. The practical point is to be on the lookout for them, to be prepared to remeasure the eye for them and give relief by a new correction. Incidentally it is evidence of an understanding of the facts of the case to ascribe an inappropriateness of glasses worn by a patient, not to incompetence of a colleague who prescribed them, but to the changes that we now know occur, altho they were not recognized by some of the pioneer investigators of ocular refraction.

E. J.

NATIONAL MEETINGS

The American Medical Association will meet in New Orleans this year, on April 26, and its Section on Ophthalmology will hold its first session the morning of April 28. When the last meeting of the association was held in New Orleans, in May, 1904, the proceedings of this section were rather notable for their scientific interest. The program already arranged for the coming meeting is equally promising.

In the last 16 years there has been progress in the medical institutions of the city, commensurate with its commercial development following the opening of the Panama canal, and the quickened business activity of the South. Tulane University with its department of ophthalmology; and the Charitable Eye, Ear, and Throat Hospital and the Eye Department of Touro Infirmary are institutions that it is worth while to get acquainted with.

On Monday, April 26, comes the annual meeting of the American Board for Ophthalmic Examinations to pass upon candidates who have submitted

applications and case reports; and to examine those who appear at the meeting for its written, oral, and practical tests.

Probably this meeting will be the busiest it has ever held, one that will bring together a larger number of applicants than its earlier sessions, even in the large Eastern cities.

It should be remembered that the meetings of the Section of Ophthalmology of the American Medical Association are the largest annual gatherings of Ophthalmologists held anywhere in the world and the most democratic. Any member of the A. M. A. can join it by registering his desire to attend its sessions.

This year Victor Morax of Paris may be its guest of honor. It is peculiarly appropriate that in this old French city of the New World, such an opportunity should be given to American ophthalmologists to see and hear this leader in ophthalmology.

To know the personality of a scientific writer and clinician is to add to the value of all we read and hear of his work. The annual gathering of this scientific body is one of the great educational opportunities that is open to any of us. While it offers the advantage of all the members speaking the same language, the experience they have had is drawn from a wider part of the earth's surface than has been available for some of the international congresses of Europe. The importance of such opportunities should not be underestimated by those who can utilize them.

The meeting of the American Ophthalmological Society is a different occasion. This oldest of American special societies, and one of the oldest national associations of opthalmology in the world—older than those of either Great Britain or France, has generally avoided large cities, except when drawn into the Triennial Congress of Physicians and Surgeons. This year it will meet at Hot Springs, Virginia, June 15 and 16.

For those who attend its meetings year after year, there is a peculiar charm about them: and every member must attend once in three years to keep his place in the Society. There are no formal entertainments. But all are living in the same hotel, they get together in groups in the dining rooms, they hold evening sessions so that the afternoons can be spent on the golf links, or in walks or rides together; and the informal comparison of experience possible on these occasions is quite as valuable as that gathered by the printer and stenographer into the annual volume of transactions.

Altho the American Ophthalmological Society restricts its membership, and has a waiting list of candidates, it ought to be more generally known that ophthalmologists who are not members of the Society are always welcome at these meetings. Formally introduced to the Society, they are given the privileges of the floor, and participate in its discussions. This opportunity for mutual acquaintance allows the Society to judge as to who of the younger men are likely to add most to the interest and value of its scientific proceedings, the high standard of which is a proper object for pride on the part of its members.

New discoveries may not be brought forward at either of these meetings to make them especially memorable in the long series of such annual gatherings; but no one who attends them with intelligent interest can fail to become wiser in ophthalmic science, and safer and more successful in the practice of his part of the healing art.

E. J.

PUBLICATION RESUMED

The Journal of OPHTHALMOLOGY, OTOLOGY AND LARYNGOLOGY, which for twenty-three years held a recognized place among the special journals of this country, suspended publication about two years ago. It now reappears, beginning volume 24 with the January number, in its old neat and attractive form. It is the official organ of the American Homeopathic Ophthalmological, Otological and Laryngological

Society; and this number is occupied chiefly by the President's Address, proceedings and papers read before the last meeting of that society, held at Asbury Park in June of last year. We welcome its former editor, Dr. G. W. Mackenzie, and his present associate, Dr. Douglas MacFarlan to their editorial labors.

H. A. FOX

Miss Harriott A. Fox, who for more than twelve years acted as publisher of the Ophthalmic Record, and since its foundation by merger has filled a similar position on the staff of the new AMERICAN JOURNAL OF OPHTHALMOLOGY, has resigned her office, to take effect the first of March. She relinquishes the post she has filled so faithfully, and so acceptably to the staff of both periodicals, with the best wishes of the Editors of this JOURNAL, for a happy future. We understand that Miss Fox, after spending several months in the East, will open an artist's studio in Chicago, and follow a profession for which she is eminently fitted.

BOOK NOTICES

The Nose. Paranasal Sinuses, Nasolacrimal Passageways, and Olfactory Organ in Man, by J. Parsons Schaeffer, A.M., M.D., Ph.D. With 204 illustrations of which 18 are printed in color. Philadelphia, P. Blakiston's Son & Co. Price $10.

This monograph, a quarto of 370 pages, is an exhaustive treatise upon the embryology, anatomy and physiology of the nose and sinuses, a modern type of essay and a valuable contribution to anatomic study, based largely upon anatomic material studied over a period of years.

We look upon the eye as a most complex organ. The nose, even to the rhinologist, is not seemingly so complicated. But when we consider the extensions of the nasal passages into the cranial bones which form the sinuses, the two-fold offices of the organ, for breathing and for smelling, and its ancillary structures—as the lacrimal canals; and if we remember that in the development of the human cranium and the face the nasal chambers have been distorted from the mammalian scheme, and that the olfactory organ is but rudimentary in man, compared to his forbears, we will at once recognize its complexity. Again there is no unvarying typical or ideal anatomic type, and we are most profoundly impressed with the ever recurring departure in morphology from the conventional or typical description.

Study of the embryology and development of the nose shows it to be a wonderful organ of morphologic intricacy, but the descriptions here given are the fullest and best that the reviewer knows of in the English language. The accessory sinuses are fully dealt with. Of particular interest to the oculist is the chapter on the nasolacrimal passageways, and new light will be gained by its perusal. In contradistinction to the usual book description, and to the general conception of the lacrimal canals, the many preparations made by the author show that it is seldom a tube. It is not often found even partially straight, but in the average case it is tortuous with diverticula which in some instances absolutely preclude the passage of a sound without penetrating outside of its lumen; and hence the fallacy and impossibility of treating a case of lacrimal obstruction in some patients by using probes.

The view of the anatomy to be gained by perusal of this chapter will be of great aid to the surgeon, not only for the external but also for the intranasal operations. The olfactory apparatus proper—the anatomy and physiology of the sense of smell is fully given—the work being mostly original, few quotations from the literature will be found. It is well printed, bound, and replete with good illustrations.

H. V. W.

There was a period in the specialization of practice, when the eye and ear furnished the field cultivated by one

group of specialists while another group confined their studies and services to the throat and chest. The nose was scarcely considered as having diseases or deformities that were of practical importance, outside of those then treated by the general surgeon. Gradually this has ben changed, and in the group of head specialists, the nose and its pathologic conditions stand at the center, connecting with all these fields of special practice. Whether the specialist seeks to confine his work to the eye, the ear, or the throat, he must make himself more or less familiar with the pathology of the nose; if he is to be thoroly prepared to deal with diseases of the part to which he has restricted his practice.

Then in rhinology, anatomy plays a proportionately more important practical part than in any other field of special practice. This gives to this work by the professor of anatomy at Jefferson Medical College its great interest for the ophthalmologist. The eye embedded in the orbit, which is largely surrounded by the nasal accessory sinuses, is in various ways likely to be affected by nasal disease; and at every point the dealing with these ocular complications rests directly on our knowledge of the anatomy of the parts surrounding the orbit.

Three of the relations of ocular to nasal disease are especially prominent today; the pathology of the nasolacrimal passages, the relations of ethmoid and sphenoid to optic nerve disease, and focal infections; while an important share of serious orbital disease comes clearly by extension from the nasal accessory sinuses.

This book is divided into chapters as follows: I, Embryology and Development. II, The Definitive Nose. III, Maxillary Sinus. IV, Frontal Sinus. V, Sphenoidal Sinus. VI, The Ethnoidal Cells. VII, Nasolacrimal Passageways. VIII, Nasal Mucous Membrane. IX, Blood and Lymph Vascular System. X, Nerves of Nose and Paranasal Sinuses. XI, The Olfactory Apparatus Proper. XII, Physiological Agenda. The index of 12 pages is exceptionally complete.

A very large part of the value of this book lies in its clear, well chosen, accurately drawn and beautifully reproduced illustrations. To these the busy practitioner can turn to refresh his memory, and fix his mental picture of all the parts that enter or adjoin his field of operation. Those who get the work will use it and be glad they have it.

E. J.

Transactions of the Pacific Coast Oto-Ophthalmological Society. The seventh Annual Meeting. San Francisco, Aug. 4-5-6, 1919, 8vo., pp. 64.

This society with more than two hundred members publishes transactions that would do credit to older and more widely known organizations. Two-thirds of the papers here published relate to Ophthalmology, and most of them are to be found in the pages of this Journal. These papers, however, gave rise to spirited and interesting discussions which are included in the "Transactions;" and we note that two of the six sessions of the meeting were devoted to clinics.

These transactions would be more useful as a work of reference if furnished with an index and table of contents; and if printed in type of reasonably large size, and in the style adopted by other societies would make a volume of more than double the number of pages.

The illustrations consist of three plates and eight charts of fields of vision, all well printed. We would suggest to ophthalmologists from other regions that this society is well worth attending.

E. J.

Ophthalmic Section, Department of Public Health, Egypt. Fifth Annual Report, by the Director of Ophthalmic Hospitals. Quarto 32 pages. Cairo Government Press.

This report by Dr. A. F. MacCallan represents the work in 1917 of 13 permanent and 4 travelling hospitals, which dealt in that year with 81,529 new patients, the total of attendance being 1,004,161; and the operations performed 59,581.

It is interesting to know that the study of ophthalmias in Egypt is being carried on upon a gigantic scale. We

have here a tabulated report of 12,642 cases of acute conjunctivitis. The diagnosis has been based on examination of the discharge under the oil immersion lens of the microscope, showing the principal causes to be in the order of frequency, the gonococcus, the Koch-Weeks bacillus and the Morax-Axenfeld bacillus. The seasonal relation of the first two are shown by tracings as compared with those of mean daily temperature. Then there are interesting tables showing the frequency and causes of blindness, incidence of primary glaucoma, causes of optic atrophy, work done at all the hospitals, list of diseases, and number of cases of each, a pathologic report on 176 specimens, etc. It is encouraging to learn that the Director with the assistance of the Inspectors gave a complete course of postgraduate lectures on ophthalmology, with pathologic and bacteriologic demonstrations and laboratory work. E. J.

Winifred Hathaway, Manual for Conservation of Vision Classes. National Committee for the Prevention of Blindness, New York City. 108 pages, illustrated.

One of the advanced factors in the moulding of public opinion, and from it the enactment and enforcement of wise rules is the National Committee for the Prevention of Blindness. Its publications are all written in a popular style, for the benefit not only of physicians and nurses, but for parents and the general public as well. We largely have this society and its professional members to thank for the publicity which has reduced the cases of ophthalmia to a minimum; and which by its efforts has secured the enforcement of protective devices for the prevention of eye accidents in America.

Here we have a new idea, the segregation of the child with poor sight in special classes at the public school, with special teachers, special equipment and books with large type and lessons which do not strain the eyes. These have been most successful in the states of Ohio, New York and Massachusetts, and progressive states with large cities will surely now take up the work.

Cooperation between the physicians, the teacher and the parents is obtained; and the child in many cases so benefited that after some months he is enabled to go into the general classes. It is stated that the best recommendation for conservation of vision classes comes from the pupil himself who may have been a dull, backward child, but who soon learns and likes his studies in most cases, keeping well up with those who are favored with strong eyes.

The pamphlet is freely and finely illustrated and is a model of proper printing.

H. V. W.

Ernest S. Bishop, M. D. The Narcotic Drug Problem; 165 pages. New York, the Macmillan Company.

Perhaps the ophthalmologist per se is not directly interested in the drug habit—for his patients seldom acquire the predilection from eye disease which calls for drugs to which an addiction may be created. But as many in America are really head surgeons, treating as they mostly do the nose, throat and ear, they have had more or less experience with dope-eaters. Indeed the cloture on the indiscriminate sale of narcotics has necessitated the careful putting away of the office narcotics as well as cocain, for if left in sight, these bottles may mysteriously disappear by theft.

The author treats the subject, as well as his patients, from the standpoint of disease. We are led to understand that there is always a pathologic reason for the beginning of the habit, a necessity for surcease from pain, for relief of a neurosis or a background of disease. Thus, for a cure, the cause must be ascertained and physiologic remedial treatment instituted.

Until the drug idea is eliminated from the doctor's mind and the concept of the disease is understood, the medical man cannot scientifically and satisfactorily cure the case.

This little book is interesting and well written. H. V. W.

NEWS ITEMS

Personals and items of interest should be sent to Dr. Melville Black, 424 Metropolitan Building, Denver, Colorado. They should be sent in by the 25th of the month. The following gentlemen have consented to supply the news from their respective sections: Dr. Edmond E. Blaauw, Buffalo; Dr. H. Alexander Brown, San Francisco; Dr. V. A. Chapman, Milwaukee; Dr. Robert Fagin, Memphis; Dr. M. Feingold, New Orleans; Dr. Wm. F. Hardy, St. Louis; Dr. Geo. F. Keiper, LaFayette, Indiana; Dr. Geo. H. Kress, Los Angeles; Dr. W. H. Lowell, Boston; Dr. Pacheco Luna, Guatemala City, Central America; Dr. Wm. R. Murray, Minneapolis; Dr. G. Oram Ring, Philadelphia; Dr. Chas. P. Small, Chicago; Dr. John E. Virden, New York City; Dr. John O. McReynolds, Dallas, Texas; Dr. Edward F. Parker, Charleston, S. C.; Dr. Joseph C. McCool, Portland, Oregon. Volunteers are needed in other localities.

DEATHS.

Dr. Michael Behrman, Visalia, Kentucky., aged thirty-eight, is believed to have died from a self-inflicted wound in the head.

Dr. Frederick James Bowles, New York City, aged sixty-seven, a member of the American Academy of Ophthalmology and Oto-Laryngology, ophthalmologist to the Bloomingdale Clinic, died in the Post-Graduate hospital, January 28th, from pneumonia.

Dr. James Jefferson Johnsoń, Captain, R. C., Braggs, Okla., aged 43, died in Siberia December 13th, from typhoid.

Dr. James M. Shorter, Macon, Ga., aged sixty-nine, oculist to the Macon Hospital and to the Southern Railroad; a member of the American Academy of Ophthalmology and Oto-Laryngology, died February 2d.

PERSONALS.

Dr. L. Webster Fox of Philadelphia has returned from a trip to Florida.

Dr. Vard H. Hulen has moved his office and residence from San Francisco to Berkeley, Calif.

Dr. Howard F. Hansell of Philadelphia spent the last week of February at the Hotel Chamberlain, Old Point Comfort, Va.

Dr. S. Lewis Zeigler of Philadelphia, we are glad to announce, has recovered from a severe attack of bronchitis, which has confined him to the house for the past three weeks.

Dr. A. Cantonnet of Paris is the ophthalmic editor of the New "La Medicine," to be published monthly, the first number of which has just appeared in Paris. Occasional numbers are to be devoted to ophthalmology.

Dr. Frederick T. Clark, having been honorably discharged from the United States Army, has resumed the practice of ophthalmology and oto-rhino-laryngology with offices at 80 Elm street, Parks building, Westfield, Mass.

Sir William T. Lister, K. C. M. G., has been appointed surgeon to the Royal London Ophthalmic Hospital. T. W. Letchworth has been appointed assistant surgeon to the Royal Eye Hospital. A. E. Reynolds has been appointed assistant ophthalmic surgeon to the Miller General Hospital, Greenwich. A. C. Roper has been appointed honorary consulting surgeon and honorary governor to the West of England Eye Infirmary, Exeter, and G. P. Hawkins has been appointed to the same institution. H. W. Archer-Hall has been appointed assistant surgeon to the Birmingham and Midland Eye Hospital. (British Journal Ophthalmology.)

SOCIETIES.

Dr. Frederick C. Lewitt has been elected chairman of the Eye, Ear, Nose and Throat Section of the San Francisco County Medical Society for the present year.

At a meeting of the Milwaukee Oto-Ophthalmology Society, on February 6, 1920, Dr. Gustavus I. Hogue was elected president of the society.

The Sioux City Eye and Ear Academy recently elected officers for the coming year. President, James E. Reeder, Sioux City; vice-president, Frank I. Putman, Sioux Falls, and secretary-treasurer, Lorenzo N. Grosvenor, Huron, S. D.

Owing to the epidemic of influenza, the joint meeting of the Minneapolis Academy of Ophthalmology and Oto-Laryngology, the Milwaukee Oto-Laryngological Club, the Chicago Oto-Laryngological Society and the Chicago Ophthalmological Society planned for February was indefinitely postponed.

The New York Association of the Blind has issued a statement saying that one of the fundamental purposes of the organization is to help newly blinded men and women adapt themselves to the changed conditions that blindness imposes.

The Ophthalmic Section of the College of Physicians of Philadelphia has elected the following officers for the year 1920: Chairman, Dr. G. Oram Ring; secretary, Dr. Milton C. Griscom; executive committee, Drs. Samuel D. Risley, Howard F. Hansell and William T. Shoemaker.

Dr. George E. de Schweinitz of Philadelphia acted as toastmaster at the dinner of the Society of the Alumni of the University of Pennsylvania, which was held at the Bellevue-Stratford Hotel on Saturday evening, February 21st. The principal addresses were made by General Atterbury, vice-president of the Pennsylvania Railroad, who was in charge of the transportation of the A. E. F. in France, and by the provost,

Edgar Fahs Smith, who, to the great regret of the Alumni, is about to retire from the position he has so conspicuously adorned.

At the February meeting of the Chicago Ophthalmological Society the following papers were read: "Ocular Manifestations in Encephalitis Lethargica," by Dr. Sidney Walker; "An Anatomical Study of Six Cases of Degeneration of the Cornea," by Dr. Charles A. Maghy; "The Economic Phase of Ophthalmology," by Dr. Austin A. Hayden.

The next annual congress of the Ophthalmological Society of the United Kingdom will be held on Thursday, Friday and Saturday, 29th and 30th of April and 1st of May, 1920. President, J. B. Story. Thursday, April 29th: Morning at the Royal Society of Medicine, 1 Wimpole street, W. L. President's opening address, papers. Afternoon: At the Royal London Ophthalmic Hospital, City Road, E. C., L. Clinical meeting, exhibition of books, museum specimens, drawings and portraits belonging to the hospital. Members will dine together in the evening. Friday, April 30, at the Royal Society of Medicine, at 10 a. m. "Discussion on Diabetes in Relation to Diseases of the Eye," to be opened by Sir Archibald Garrod, Mr. R. Foster Moore, and Dr. E. Spriggs, and the following: Dr. Leyton, Mr. G. Mackey, Dr. Poynton, Mr. P. H. Adams, Dr. Cammidge, Mr. Gray Clegg and Dr. A. Renshaw. 5:30 p. m., business meeting; 8:30 p. m., papers. Saturday, May 1st, at 10 a. m. Visit to St. Margaret's Hospital, Leighton Road, N. W. 5, the special hospital of the Metropolitan Asylums Board for cases of ophthalmia neonatorum. Discussion on "The Prevention and Treatment of Ophthalmia Neonatorum," to be opened by Dr. Gibbon Fitzgibbon, master of the Rotunda Hospital, and Mr. M. S. Mayou. The following also will speak: Mrs. Scharlieb, Dr. Macrory, Messrs. Sydney Stephenson, Maitland Ramsay and J. Wharton.

R. R. James and F. A. Juler, Hon. Secs.

MISCELLANEOUS.

By the will of the late Mrs. Eliza Avius of Birmingham one thousand pounds were bequeathed to the Birmingham Eye Hospital.

The Anales de la Soc. Mexicano de Oftalmologia with its second volume has enlarged its pages to include oto-laryngology.

The Norwegian Societe des Sciences, of Christiania, has awarded the Fridtjof Nansen prize to H. Shiötz and S. Holth for their remarkable work on glaucoma.

Henry S. Pritchett, president of the Carnegie Foundation for the Advancement of Teaching, pays a very beautiful tribute to Christian R. Holmes in a letter to the editor of the Journal of the American Medical Association in the issue of February 7th. It is well worth reading.

Starting in 1915 with sixty-five charter members, the National Committee for the Prevention of Blindness now has enrolled nearly twenty-three hundred members in forty-seven states, in Cuba, the Philippines, Porto Rico, Mexico, China and Canada. It has pushed laws for the prevention of blindness and had them passed in eighteen states.

A most imposing ceremony and historical pageant ushered in the inaugural exercises of the University of Strasbourg under French rule on November 21st. The president of the republic and three marshals of France took part in the festivities, also delegates from many universities in France and abroad. Dr. Duverger is professor of Ophthalmology in the university.

In the will of the late Christian R. Holmes of Cincinnati he sets aside a fund of $25,000 to provide for the establishment of a journal for the medical department of the University of Cincinnati.

The friends of Christian R. Holmes have planned to raise a fund of $1,000,000 for medical research, the endowment to be known as the Christian R. Holmes Medical Research Fund. The Carnegie Corporation has made a gift of $250,000 to the Medical College of the University of Cincinnati as a tribute to Dr. Holmes' services to humanity and to endow a chair in his memory.

The Medical Summary, commenting on a request for a good glaucoma treatment, shows its appreciation of the situation in the following: "If any of the brothers happen to be in possession of a medical cure of cancer, an unfailing specific against pneumonia, and a certain preventive against death, will they not also publish these? We must get together, brothers, and help each other out."

The general assembly of Ohio recently provided funds for a campaign against trachoma. The work will be done in cooperation with the United States Public Health Service and local health authorities. The entire state will not be canvassed at one time, but intensive campaigns will be conducted in individual counties. Clinics will be established, school children will be examined and treated. Educational measures will be carried out.

The thirty-eighth annual business meeting of the Pennsylvania Home Teaching Society and Free Circulating Library for the Blind, elected the following for the ensuing year: Dr. L. Webster Fox, president; John E. Baird, vice-president; Ellis A. Gimbel, vice-president; John J. Wilkinson, treasurer, and Mrs. Isabel W. Kennedy, secretary.

According to the report of the secretary, during the past year the seven home teachers, all but one of whom are blind or partially blind, paid 5,936 visits to the blind in the following counties: Philadelphia, Clinton, Center, Erie, Crawford, Lawrence, Beaver, Allegheny, Washington and Indiana; 26,928 volumes, in six different type, were circulated during the same period, and free writing, knitting, typewriting, crocheting and sewing were given.

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